Pharmacology Basics

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Abstract

Pharmacology basics is an important topic for nurses, as medications have a great power to both help and to harm patients. The basic principles of pharmacology, pharmacokinetic processes including absorption, distribution, metabolism and excretion, as well as several drug classes and some of the commonly seen drugs within those classes are discussed.

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Continuing Education Credit Designation

This educational activity is credited for 4 hours. Nurses may only claim credit commensurate with the credit awarded for completion of this course activity.

Pharmacology content is 4 hours.

Statement of Learning Need

Pharmacology is a rapidly growing area of health research and medicine. Nurses need to understand the basics of drug classifications and principles underlying the use of certain medications. Nurses are important contributors to pharmacology research and practice standards.

Course Purpose

To improve nursing knowledge of the basics of pharmacology and to prepare them for more advanced learning of drug categories and treatments.

Target Audience

Advanced Practice Registered Nurses and Registered Nurses

(Interdisciplinary Health Team Members, including Vocational Nurses and Medical Assistants may obtain a *Certificate of Completion*)

Course Author & Planning Team Conflict of Interest Disclosures

Elizabeth Boldon, RN, MSN, William S. Cook, PhD, Douglas Lawrence, MA, Susan DePasquale, MSN, FPMHNP-BC – all have no disclosures

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There is no commercial support for this course.

Activity Review Information

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Please take time to complete a self-assessment of knowledge, on page 4, sample questions *before* reading the article.

Opportunity to complete a self-assessment of knowledge learned will be provided at the end of the course.

1. **Pharmacokinetics is the branch of pharmacology that:**
   a. deals with determining the movement (kinetics) of drugs into and out of the body
   b. explains how drugs are manufactured
   c. addresses only the risks and benefits of medication
   d. answers b and c above
2. **Controlled medications are divided into _____ schedules based on their potential for abuse and physical and psychological dependence.**
   a. 3
   b. 4
   c. 5
   d. 7
3. **A medication will have a generic name and one or more trade names. The generic name:**
   a. usually signifies the medication's chemical derivation
   b. may either be determined by the company that first developed the drug, or a by the U.S. Adopted Name Council
   c. are written beginning with a lower case (small) letter
   d. all of the above
4. **True or False. Anticoagulants are a class of drugs commonly used to prevent the blood from forming dangerous clots.**
   a. True
   b. False
5. **True or False. Neostigmine and bethanechol are examples of cholinergic blockers.**
   a. True
   b. False

Introduction

Did you ever wonder how Tylenol knows to go to your head when you have a headache and to your elbow when you have "Tennis Elbow"? Or how one or two small tablets containing only 500-1000 mg of active drug can relieve a headache or ease the inflammation of a strained muscle or tendon in a 185 lb. athlete?

This course will describe the basic principles of pharmacology, pharmacokinetic processes including absorption, distribution, metabolism and excretion, as well as several drug classes and some of the commonly seen drugs within those classes. *Pharmacology Basics* is an important topic as medications have a great power to both help patients (in terms of curing disease or infection, relieving symptoms such as pain or nausea) and to harm patients (in terms of allergic reactions, overdoses, adverse reactions, or administering the wrong medication to the wrong patient.) All members of the healthcare team who deal, in any way with medications, should respect the power of medications and act accordingly.

Receptors

The answer to the question in the introduction is that drugs are distributed throughout the body by the blood and other fluids of distribution. Once they arrive at the proper site of action, they act by binding to receptors, usually located on the outer membrane of cells, or on enzymes located within the cell.

Receptors are like biological "light switches" which turn on and off when stimulated by a drug, which binds to the receptor and activates it. For

example, narcotic pain relievers like morphine bind to receptors in the brain that sense pain and decrease the intensity of that perception. Non-narcotic pain relievers like aspirin, Motrin (ibuprofen) or Tylenol (acetaminophen) bind to an enzyme located in cells outside of the brain close to where the pain is localized (*i.e*., hand, foot, low back, but not in the brain) and decrease the formation of biologically-active substances known as prostaglandins, which cause pain and inflammation. These "peripherally-acting" (act outside of the central nervous system (CNS) analgesics may also decrease the sensitivity of the local pain nerves causing fewer pain impulses to be sensed and transmitted to the brain for appreciation.

In some instances, a drug's site of action or "receptor" may actually be something that resides within the body, but is not anatomically a part of the body. For example, when you take an antacid like Tums or Rolaids, the site of action is the acid in the stomach that is chemically neutralized. However, if you take an over-the-counter (OTC) medication that inhibits stomach acid production instead of just neutralizing it (*i.e*., Tagamet (cimetidine) or Pepsid-AC (famotidine), these compounds bind to and inhibit receptors in the stomach wall responsible for producing acid.

Another example of drugs, which bind to a receptor that is not part of your body, is antibiotics. Antibiotics bind to portions of a bacterium that is living in your body and making you sick. Most antibiotics inhibit an enzyme inside the bacteria that causes the bacteria to either stop reproducing or to die from inhibition of a vital biochemical process.

In many instances, the enzyme in the bacteria does not exist in humans, or the human form of the enzyme does not bind the inhibiting drug to the same

extent that the bacterial enzyme does, thus providing what pharmacologists call ”Selective Toxicity". Selective toxicity means that the drug is far more toxic to the sensitive bacteria than it is to humans thus providing sick patients with a benefit that far outweighs any risks of direct toxicity. Of course, this does not mean that certain patients won't be allergic to certain drugs.

Penicillin is a good example of this. Although penicillin inhibits an enzyme found in sensitive bacteria which helps to "build" part of the cell wall around the outside of the bacteria, and this enzymatic process does not occur in human cells, some patients develop an allergy to penicillin (and related cepahlosporin) antibiotics. This allergy is different from a direct toxicity and demonstrates that certain people's immune system become "sensitized" to some foreign drug molecules (xenobiotics), which are not generally found in the body.

As medical science has learned more about how drugs act, pharmacologists have discovered that the body is full of different types of receptors that respond to many different types of drugs. Some receptors are very selective and specific, while others lack such specificity and respond to several different types of drug molecules. To date, receptors have been identified for the following common drugs, or neurotransmitters found in the body: narcotics (morphine), benzodiazepines (Valium, Xanax), acetylcholine (nicotinic and muscarinic cholinergic receptors), dopamine, serotonin (5-hydroxytryptamine; 5-HT), epinephrine (adrenalin) and norepinephrine (a and b adrenergic receptors), and many others.

Neurotransmitters are chemicals released from the end of one neuron (nerve cell) that diffuse across the space between neurons called the synaptic cleft, and stimulate an adjacent neuron to signal the transmission of information.

Pharmacokinetics

The next part of this course is designed to explain the complicated journey of a drug through the body, which pharmacologists call pharmacokinetics. Pharmacokinetics is the branch of pharmacology, which deals with determining the movement (kinetics) of drugs into and out of the body. Experimentally, this is done by administering the drug to a group of volunteer subjects or patients and obtaining blood and urine specimens for subsequent quantitative (how much) analysis. When the results of these analyses are plotted on graph paper with blood levels or urinary excretion on the vertical axis and time on the horizontal axis, a blood level-time or urinary excretion pattern is obtained. These graphs can be used to calculate the rates of appearance and elimination of the drug in the bloodstream, the rates of formation of the compounds into which the drugs are transformed in the liver (metabolized), and finally the rates of elimination or excretion of the metabolites.

There are four scientific or pharmacokinetic processes to which every drug is subject in the body:

1. Absorption
2. Distribution
3. Metabolism
4. Excretion

These four processes occur contemporaneously until, firstly, the entire drug is absorbed from the GI tract, the muscle or subcutaneous tissue site into which it was injected, and there is no more absorption phase; and, secondly, all of the drug has been metabolized, and there is no more "parent" drug and it is no longer detectable in the blood.

Absorption

Absorption is the process by which a drug is made available to the fluids of distribution of the body (*i.e*., blood, plasma, serum, aqueous humor, lymph, *etc.*).

In the fasting state, most orally-administered drugs reach a maximum or "peak" blood concentration within one to two hours. Intravenous (IV) administration is the most rapid route of administration, with intra-nasal, smoking (inhalation), sublingual (under the tongue), intra-muscular (IM), subcutaneous (*i.e*., under the skin, SC or SQ), and percutaneous (through the skin) being the next most rapid.

The *rate* of absorption of orally-administered drugs and the subsequent appearance of the drug in the blood is dependent on the following factors:

1. The rates of disintegration and dissolution of the pill or capsule in the stomach or gastrointestinal (GI) tract.
2. The solubility of the drug in stomach or intestinal fluids (the more soluble, the faster).

3. The molecular charge on the drug molecule (charged substances are soluble, but don't pass through lipid (fat) soluble biologic membranes well).

4. Aqueous (water) solubility vs. lipid (fat) solubility. Water-soluble drugs are soluble but don't pass through lipid-soluble biologic membranes well.

5. The presence or absence of food in the stomach (food delays the absorption of some drugs and enhances the absorption of others).

6. The presence of any concomitant medication(s) that can interfere with gastrointestinal (GI) motility, *i.e.*, Reglan increases GI motility, Aluminum antacids slow, drugs like atropine or scopolamine used for ulcers or "queasy stomachs" slow GI motility keeping some drugs in the stomach slowing absorption, while drugs like Tagamet, Zantac and Prilosec (Pepcid-AC) decrease gastric acid production increasing the rate of gastric emptying and increasing the rate of absorption of some drugs.

Distribution

Once a drug has been absorbed from the stomach and/or intestines (GI Tract) into the blood, it is circulated to some degree to all areas of the body to which there is blood flow. This is the process of distribution. Organs with high blood flow, *i.e.*, brain, heart, liver, etc. are the first to accumulate drugs, while connective tissue and lesser-perfused organs are the last.

The pattern of distribution of drug molecules by different tissues after the chemical enters the circulatory system varies. Because of differences in pH,

lipid content, cell membrane functions, and other individual tissue factors, most drugs are not distributed equally in all parts of the body. For example, the acidity of aspirin influences a distribution pattern that is different from that of an alkaline product such as amphetamine.

Many drugs are bound to plasma proteins such as albumin. Since only drugs that are not bound are free to exert a pharmacologic effect, the ratio of "free" to "bound" drug is important in determining the onset and duration of action of drugs. Highly bound drugs are distributed less extensively throughout the body and are slower to act. By virtue of their high binding to plasma proteins, they also stay in the body for longer periods of time because the binding sites act as a sort of "reservoir" for the drug, releasing drug molecules slowly. One example of commonly used extended release mediation is Effexor XR (an antidepressant medication.) Most extended release mediations will have XR, ER or XL in their name.

Metabolism

Drugs in the blood and tissues must be inactivated and excreted from the body. This process is initiated by altering the chemical structure of the drug in such a way as to promote its excretion. The transformation of the drug molecule into a chemically related substance that is more easily excreted from the body is called metabolism, biotransformation or detoxification.

Drug metabolism is the process by which the body breaks down and converts medication into active chemical substances. Drugs can interact with other drugs, foods, and beverages. Interactions can lessen or magnify the desired therapeutic effect of a drug, or may cause unwanted or unexpected

side effects. There are thousands of possible drug-to-drug and drug-to-food interactions, and many medications and supplements are contraindicated (not recommended) under certain conditions or in patients with specific diseases and disorders. This is why it is imperative that patients always keep their physician fully informed about all drugs and dietary supplements (including herbal remedies) they are taking.

The primary site of drug metabolism is the liver, the organ that plays a major role in metabolism, digestion, detoxification, and elimination of substances from the body. Enzymes in the liver are responsible for chemically changing drug components into substances known as metabolites. Metabolites are then bound to other substances for excretion through the lungs, or bodily fluids such as saliva, sweat, breast milk, and urine, or through reabsorption by the intestines. The primary mode of excretion is through the kidneys and will be described further in the next section.

The family of liver isoenzymes known as cytochrome P-450 are crucial to drug metabolism. These enzymes (labeled CYP1A2, CYP2C9, CYP2C19, CYP2D6, and CYP3A4) have a catabolic action on substances, breaking them down into metabolites. Consequently, they also act to lower the concentration of medication in the bloodstream.

Drug interactions can occur when one drug inhibits or induces a P-450 that acts on another drug. An example is nicotine, a drug contained in tobacco, and known to induce P-450s. Individuals with liver disease (*i.e.*, cirrhosis) may also have insufficient levels of P-450 enzymes. As a result, the concentration of drugs metabolized by these enzymes (*i.e.*, amprenavir and

other protease inhibitors) remains high and can build up to toxic levels in the bloodstream. In addition, certain medications and foods, such as grapefruit juice, can inactivate or lessen the metabolic activity of P-450s. Changing the drug dosage can alleviate the problem in some cases.

The metabolic rate can vary significantly from person to person, and drug dosages that work quickly and effectively in one individual may not work well for another. Factors such as genetics, environment, nutrition, and age also influence drug metabolism; infants and elderly patients may have a reduced capacity to metabolize certain drugs, and may require adjustments in dosage.

In the case of ethanol, the alcohol molecule is metabolized in the liver by the enzyme alcohol dehydrogenase, to acetaldehyde that causes dilatation of the blood vessels and, after accumulation, is responsible for the subsequent hangover that ensues. The acetaldehyde is subsequently metabolized by the enzyme aldehyde dehydrogenase to acetate, a substance very similar to acetic acid or vinegar.

Therapeutic agents like antibiotics and drugs used for the treatment of high blood pressure, epilepsy (*i.e.*, phenobarbital, Dilantin), pain (*i.e.*, morphine, codeine), anxiety (*i.e.*, Valium, Xanax) are also metabolized to chemically-related compounds called metabolites, which are then excreted in the urine.

Drugs that commonly interact with other medications include the following categories:

- Diuretics:

  Diuretics such as hydrochlorothiazide can reduce serum potassium and sodium electrolyte levels when taken with digoxin and lithium, respectively.

- Monoamine oxidase inhibitors (MAOIs):

  MAOI antidepressants can cause convulsions and other serious side effects when used with tricyclic antidepressants (*i.e.*, Imipramine, Nortriptyline), selective serotonin reuptake inhibitors (SSRIs), or sympathomimetic drugs (*i.e.*, amphetamines).

- Antibiotics:

  Antibiotics may reduce the efficiency of oral contraceptives.

- Metals:

  Medications containing metals, such as antacids with aluminum additives and iron supplements, can reduce the absorption of tetracyclines and fluoroquinolones.

Drugs that inhibit liver enzyme function:

Drugs that slow drug metabolism include ciprofloxacin, erythromycin, fluoxetine, nefazodone, paroxetine, and ritonavir. The therapeutic effect of other medications taken with these drugs may be amplified. Warfarin, a blood thinner, should be used with great caution in individuals taking these drugs.

Foods and beverages that may interact with drugs include:

- Grapefruit juice:

  Grapefruit juice inhibits the metabolism of many medications, including cyclosporine, felodipine, nifedipine, nitrendipine, nisoldipine, carbamazepine, triazolam, and midazolam.

- Foods and beverages with tyramines:

  Red wine, malted beers, smoked foods (*i.e.*, fish and meats), dried fruits, and aged cheeses may contain tyramines, and can cause a severe and dangerous elevation in blood pressure when taken with MAOI inhibitors (a class of antidepressants).

- Dairy products:

  Milk, cream, and other dairy products containing calcium can prevention the absorption of antibiotics such as tetracycline, doxycycline, and ciprofloxacin when they are taken with the drug. In addition, whole milk with vitamin D can cause milk-alkali syndrome in patients taking aluminum hydroxide antacids.

- Caffeinated beverages:

  The caffeine contained in coffee and colas can influence drug metabolism.

- Alcohol:

  Alcohol is a central nervous system depressant, and should not be taken with other CNS depressants (*i.e.*, antipsychotics,

antihistamines). In addition, certain fermented beverages may contain tyramines.

This list is not all-inclusive and individuals should always let their doctor and pharmacist know when they are taking other medications, herbal remedies, or dietary supplements. Anyone who experiences a serious reaction to a drug that is not consistent with its product labeling should report the event to their doctor and/or the MedWatch adverse event reporting system of the United States Food and Drug Administration (FDA).

Excretion

Excretion is the process by which a drug is eliminated from the body. Drugs can be excreted by various organs including the kidney and lungs, and found in many biological fluids like: bile, sweat, hair, breast milk, or tears. However, the most common fluid in which to look for drugs is the urine.

In order to determine the rate of excretion of any drug from blood, one must first be certain that the entire drug in the subject's GI tract has been absorbed. If not, calculation of a rate of excretion would be confounded be the ongoing absorption of more drug. Once the entire drug has been absorbed, this is called the post-absorbtive, or distributive stage. At this time, serial (multiple) blood level determinations should show a decline with time. The amount of time required to eliminate half of the drug from the body is called the *half-life*.

Generally, it takes six half-lives to rid the body of 98% of a drug and 10 half-lives to completely eliminate the drug from the body. Using these mathematical relationships allows pharmacologists to determine how often a therapeutic drug should be administered to a patient or toxicologists to determine a time interval within which one would test positive for drugs of abuse.

Drug Nomenclature

A medication will have a generic name and one or more trade names. The generic name usually signifies the medication's chemical derivation. However, this may not always be the case, at times generic names are either determined by the company that first developed the drug, or a by the U.S. Adopted Name Council. Generic names are written beginning with a lower case (small) letter.

The trade name is a name chosen by a pharmaceutical company for purposes of marketing or to identify the company responsible for manufacturing the drug. The trade name may also represent some property of the drug. Trade Names usually begin with a capital letter and may be followed by a Trademark. A single drug may have many different trade names.

Examples of generic and trade names are listed in the table below.

Generic	Trade
Ibuprofen	Motrin®
Acetaminophen	Tylenol®
benzoyl peroxide	Oxy10®

Drug Classifications

Drugs are classified into different groups according to their chemical characteristics, structure and how they are used to treat specific diseases. One way to classify medications is as *controlled* versus *non-controlled*. Non-controlled medication is medication that is not considered to be a depressant or a stimulant and is not considered addictive or with a potential for abuse. Non-controlled medication may include over-the-counter medication or prescription medication. Controlled medications are divided into five schedules based on their potential for abuse and physical and psychological dependence.

1. *Schedule I*:

   Drugs that currently do not have accepted medical use, have a high potential for abuse, and lack accepted safety measures for use (*i.e.*, LSD, peyote, heroin).

2. *Schedule II*:

   Drugs that have medical use and a high potential for abuse; those that tend to cause severe dependence (*i.e.*, morphine, secobarbital, amphetamines (Ritalin), methadone).

3. *Schedule III*:

   Drugs used in medical practice with less potential for abuse than schedule II drugs; those that tend to cause moderate or low physical dependence or high psychological dependence (*i.e.*, nalorphine, drug combinations containing small amounts of narcotics such as codeine).

4. *Schedule IV*:

   Drugs that have medical use and lower potential for abuse than schedule III drugs; those that tend to cause limited physical or psychological dependence (*i.e*., meprobamate, chlordiazepoxide, diazepam).

5. *Schedule V*:

   Drugs that have medical use and lower potential for abuse than schedule IV drugs; those that tend to cause less physical or psychological dependence (*i.e*., mixtures of limited quantities of narcotics such as cough syrups containing codeine).

Medications may be classified or categorized in a number of other ways. Medications may be classified by function or use. For example, an anti-anxiety medication is used to treat anxiety, tension and nervousness. An antidepressant treats depression by elevating the mood. Medication may also be classified by the body system that it affects. Cardiovascular drugs work on the heart and blood systems. Gastrointestinal medicines work on the stomach and intestinal tract.

Most of the medications within a classification group, like alpha-adrenergic blockers, are quite similar although they are not identical. Classification systems enable us to readily identify the similarities and differences among a large number of medications within and outside of a particular classification.

One of the best and most efficient ways to master pharmacology is to become familiar with the classifications of medications and then to focus on

the similarities and differences of medications within the same classification. Below are some of the commonly seen classes of medications, their actions, uses, adverse reactions and side effects, contraindications, implications, and examples of medications within that class.

Alpha-Adrenergic Blockers

Alpha-blockers relax certain muscles and help small blood vessels remain open. They work by keeping the hormone norepinephrine (noradrenaline) from tightening the muscles in the walls of smaller arteries and veins. Blocking that effect causes the vessels to remain open and relaxed. This improves blood flow and lowers blood pressure. Because alpha-blockers also relax other muscles throughout the body, these medications can help improve urine flow in older men with prostate problems.

Actions	They bind to α-adrenergic receptors thus leading to the dilation of peripheral blood vessels, lowering of peripheral resistance and the lowering of blood pressure.
Uses	Hypertension and prevention of necrosis secondary to extravasation.
Adverse Reactions/Side Effects	Hypotension, stuffed nasal passages, tachycardia, diarrhea, nausea, and vomiting.
Contraindications	Myocardial infarction and coronary artery disease, including angina.
Implications	Potassium, Sodium, Carbon dioxide, daily weights, intake and output data as well as standing and lying blood pressures.
Examples	• dihydroergotamine mesylate • phentolamine mesylate

Antacids

Antacids are taken by mouth to relieve heartburn, sour stomach, or acid indigestion. They work by neutralizing excess stomach acid. Some antacid combinations also contain simethicone, which may relieve the symptoms of excess gas. Antacids alone or in combination with simethicone may also be used to treat the symptoms of stomach or duodenal ulcers.

Actions	They contain magnesium, aluminum, calcium and a combination of these compounds. They slow down the rate of gastric emptying and neutralize gastric acidity.
Uses	Gastritis, peptic ulcer, hiatal hernia and reflux esophagitis.
Adverse Reactions & Side Effects	Constipation, diarrhea, flatus, abdominal distention, alkaluria.
Contraindications	Allergy and sensitivity
Implications	Assess epigastric pain, gastrointestinal symptoms and renal problems and electrolytes.
Examples	aluminum carbonate and calcium carbonate

Antianginals

An antianginal is a medication which is used to treat angina, a form of chest pain which develops when the supply of blood to the heart becomes restricted. There are a number of drugs, which fit into the antianginal drug class, and they can be used in a variety of different ways. In an episode of angina, the patient experiences chest pain because the heart is not getting enough blood, and it goes into distress as a result of not receiving the supply of oxygen it needs. Angina can take a number of different forms, and is often linked with cardiovascular disease such as coronary artery disease. The purpose of an antianginal is to either increase the supply of blood to the heart, or to decrease the heart's demand for oxygen. This classification is

further divided into nitrates, calcium channel blockers and beta-adrenergic blockers.

Actions	**Nitrates** - dilate coronary arteries, decrease preload and afterload. **Calcium channel blockers**- also dilate coronary arteries, but they also decrease SA/AV node conduction **β -Adrenergic blockers**- slow the heart rate, thus decreasing oxygen use.
Uses	Angina. Calcium channel blockers and β-blockers can also be used for hypertension and dysrhythmias.
Adverse Reactions & Side Effects	Postural hypotension, fatigue, dysrhythmias, headache, edema, dizziness.
Contraindications	Increased intracranial pressure, cerebral hemorrhage and sensitivity.
Implications	Monitor for side effects and orthostatic blood pressure. Continue to assess angina pain.
Examples	• propranolol • verapamil hydrochloride • nitroglycerine

Anticholinergics

There are two types of anticholinergics: short-acting and long-acting. The short-acting type relieves symptoms and the long-acting type helps prevent breathing problems. Short-acting anticholinergics are used for treating stable Chronic Obstructive Pulmonary Disease (COPD) in a person whose symptoms come and go (intermittent symptoms). Long-acting anticholinergics are effective and convenient for preventing and treating COPD in a person whose symptoms do not go away.

Anticholinergics relax and enlarge (dilate) the airways in the lungs, making breathing easier (bronchodilators). They may protect the airways from spasms that can suddenly cause the airway to become narrower (bronchospasm). They also may reduce the amount of mucus produced by the airways.

Actions	Inhibit acetylcholine (autonomic nervous system)
Uses	Many uses- some decrease gastrointestinal, urinary and biliary motility; others decrease gastrointestinal secretions, decrease involuntary movement, and relieve nausea, and vomiting.
Adverse Reactions & Side Effects	Dryness of the mouth, paralytic ileus, constipation, urinary problems (retention and hesitancy) dizziness and headache.
Contraindications	Gastrointestinal or urinary obstruction, narrow-angle glaucoma, and myasthenia gravis.
Implications	Monitor urinary and bowel function as well as vital signs. Keep the patient in bed for one hour after parenteral dose.
Examples	• atropine sulfate • scopolamine

Anticoagulants

Anticoagulants are a class of drugs commonly used to prevent the blood from forming dangerous clots that could result in a stroke. Often called "blood thinners," anticoagulants are often the first medication prescribed by doctors following a stroke or myocardial infarction (MI).

By reducing the ability of the blood to clot — and thereby reducing the likelihood of coronary or vascular emboli — anticoagulants are frequently used in patients who are already at high-risk for stroke or MI.

Actions	Prevent clot formation.
Uses	Myocardial infarction (MI), pulmonary embolus, deep vein thrombosis, disseminated intravascular clotting syndrome (DIC), and atrial fibrillation. It is also used with dialysis.
Adverse Reactions & Side Effects	Hemorrhage, diarrhea, fever, rash and blood disorders (leukopenia, thrombocytopenia, *etc*.) depending on the specific drug.
Contraindications	Bleeding disorders, such as hemophilia and leukemia, ulcers, blood dyscrasias, nephritis, endocarditis and thrombocytopenia purpura.
Implications	Observe for bleeding (oral, black stools, stool occult blood, ecchymosis, etc.). Monitor labs such as hemoglobin, hematocrit, prothrombin time (PT), international normalized ratio (INR) and partial thromboplastin time (PTT), vital signs and blood pressure as hypotension may occur).
Examples	• warfarin sodium • heparin

Anticonvulsants

Anticonvulsants are drugs that prevent or reduce the severity and frequency of seizures. The different types of anticonvulsants may act on different

receptors in the brain and have different modes of action. This classification is further divided into barbituates, hydantoins, succinimides, benzodiazepines and others.

Actions	*To prevent seizures.*
Uses	Depending on the specific drug, they prevent tonic-clonic seizures, psychomotor seizures, status epilepticus, petit mal seizures and cortical focal seizures.
Adverse Reactions & Side Effects	Bone marrow depression, which can be life-threatening, gastrointestinal problems, Central Nervous System effects like confusion, ataxia and slurring of speech.
Contraindications	*Allergy or sensitivity*
Implications	Monitor hepatic and renal function, blood, mental status, blood dyscrasias, and toxicity (ataxia, bone marrow depression, nausea, vomiting, cardiovascular problems, Stevens-Johnson syndrome)
Examples	• phenytoin • diazepam

Antidepressants

Antidepressants are a class of drugs that reduce symptoms of depressive disorders by correcting chemical imbalances of neurotransmitters in the brain. Chemical imbalances may be responsible for changes in mood and behavior. Antidepressants are further divided into MAOIs, tricyclics, and others.

Actions	**MAOIs**- inhibit MAO and thus they increase epinephrine, norepinephrine, serotonin, and dopamine. **Tricyclics**- block the reuptake of serotonin and norepinephrine in the nerve endings, thus increasing the actions of both in the nerve cells.
Uses	Depression. Nocturnal enuresis in children.
Adverse Reactions & Side Effects	Orthostatic hypotension, mouth dryness, dizziness, drowsiness, urinary retention, hypertension, renal failure and paralytic ileus.
Contraindications	Hypertrophy of the prostate, seizure disorders, renal, hepatic and cardiac disease.
Implications	Monitor standing and lying blood pressure, blood, mental status, hepatic function. Observe for extrapyramidal symptoms and urinary retention. Withdrawal symptoms occur with abrupt cessation.
Examples	• sertraline • amitriptylyline • bupropion • phenelzine • Lithium

Antidiabetic Medications

Antidiabetic drugs are developed to stabilize and control blood glucose levels amongst people with diabetes. Antidiabetic drugs are commonly used to manage diabetes. There are a number of different types of antidiabetic drug including insulins of varying kinds and oral hypoglycemic agents.

Actions	Insulin- lowers blood sugar, potassium and phosphate Oral hypoglycemic agents- stimulate the β -cells of the pancreas to release insulin.
Uses	Diabetes and ketoacidosis
Adverse Reactions & Side Effects	Hypoglycemia, hepatotoxicity, allergic responses
Contraindications	Oral agents are contraindicated for juvenile diabetes and ketoacidosis.
Implications	Monitor blood glucose, assess for hypoglycemia, rotate insulin injection sites, and use human insulin with pork or beef sensitivity.
Examples	• insulin • glyburide

Antidiarrheal Medications

Antidiarrheal medications are used to treat sudden diarrhea (including traveler's diarrhea). They work by slowing down the movement of the gut. This decreases the number of bowel movements and makes the stool less watery. Loperamide is also used to reduce the amount of discharge in patients who have undergone an ileostomy. It is also used to treat on-going diarrhea in people with inflammatory bowel disease.

Actions	Varying. Some decrease water content of stool, some slow down gastrointestinal peristalsis.
Uses	Diarrhea
Adverse Reactions & Side Effects	Constipation, paralytic ileus, abdominal pain.
Contraindications	Colitis
Implications	Used for short-term therapy (48 hours or less). Monitor electrolytes and bowel response.
Examples	• bismuth subgallate • kaolin and pectin mixtures • loperamide

Antidysrhythmics

Antidysrhythmics are used for the treatment of cardiac dysrhythmia, which is any change from the normal heartbeat rhythm. Cardiac dysrhythmia includes not only bradycardia but also tachycardia.

There are four classes of antidysrhythmic medications. Many of these medications act on the sinoatrial (SA) and atrioventricular (AV) nodes as described below.

Actions	**Class I**- decreases any disparity in the refractory period, increases the duration of action potential and effective refractory period. **Class II**- slows down the rate of SA node discharge and conduction through the AV node. Increases recovery time and decreases the heart rate, thus lowering oxygen consumption in the myocardium. **Class III**- increases effective refractory period as well as the duration of action potential. **Class IV**- decreases SA node discharge and slows the conduction velocity through the AV node. They also inhibit calcium movement across the cell. **Others**- slows conduction through the AV node (adenosine) and increases the refractory period in the AV node and decreases conduction velocity (digoxin).
Uses	Atrial and ventricular arrhythmias (atrial fibrillation, PVCs, and tachycardia), hypertension, and angina.
Adverse Reactions & Side Effects	Hypotension, bradycardia, other arrhythmias and various other wide ranging side effects.
Contraindications	Various. Check each medication.
Implications	Monitor rate and rhythm, blood pressure, potassium, dependent edema and intake and output.
Examples	• digoxin • procainamide • quinidine • acebutolol

Antifungals

Antifungal medications are used to treat fungal infections. Antifungal medicines work by either killing the fungal cells – for example, by affecting a substance in the cell wall, causing the contents of the cell to leak out and the cell to die or preventing the fungal cells from growing and reproducing.

Actions	Decreases sodium, potassium and nutrients in the cell and increases cell permeability.
Uses	Fungal infections such as cryptococcosis, aspergillosis, histoplasmosis, blastomycosis, coccidiomycosis, phycomycosis, and candidiasis
Adverse Reactions & Side Effects	Renal, liver damage and failure, gastroenteritis, hypokalemia, anorexia, nausea and vomiting.
Contraindications	Sensitivity and bone marrow depression.
Implications	For IV administration, use a filter, check for extravasation and protect from light (cover with foil). Monitor vital signs, intake and output, blood, weight, renal and hepatic function, hypokalemia and ototoxicity.
Examples	• nystatin • amphotericin B

Antihistamines

Antihistamines work well to relieve symptoms of different types of allergies, including seasonal (hay fever), indoor, and food allergies. Antihistamines come in different forms, including tablets, capsules, liquids, nasal sprays, and eye drops. Some are only available by prescription. Others can be bought over the counter (OTC).

Actions	Antagonists of histamine.
Uses	Allergies, pruritus and rhinitis.
Adverse Reactions & Side Effects	Most cause drowsiness, headache, urinary retention, blood dyscrasias, thickened bronchial secretions and gastrointestinal effects
Contraindications	Sensitivity, asthma, peptic ulcer, narrow angle glaucoma.
Implications	Monitor urinary, respiratory and cardiac status. Also monitor for blood dyscrasias.
Examples	• diphenhydramine hydrochloride • chlorpheniramine maleate • Allegra (fexofenadine) • Benadryl (diphenhydramine) • Dimetane (brompheniramine) • Claritin, Alavert (loratadine) • Tavist (clemastine) • Chlor-Trimeton (chlorpheniramine) • Zyrtec (certirizine)

Antihypertensives

Medications used to treat high blood pressure are further divided into:

- angiotensin-converting enzyme (ACE) inhibitors
- b-adrenergic blockers
- calcium channel blockers
- centrally acting adrenergics
- diuretics
- peripherally acting antiadrenergics
- vasodilators

Actions	Angiotensin-converting enzyme inhibitors - dilatation of the arterial and venous systems occur through the suppression of renin-angiotensin I to angiotensin II conversion. Centrally acting adrenergics - inhibit impulses in the central nervous system and the sympathetic nervous system, decreases cardiac output, blood pressure and pulse rate. Peripherally acting antiadrenergics - inhibit the release of norepinephrine thus decreasing sympathetic vasoconstriction. Vasodilators - reduce blood pressure, cardiac rate and cardiac output because these medications relax and dilate the smooth muscle of the arteries. b-Blockers, calcium channel blockers, and diuretics are discussed in another section below.

Uses	Hypertension, heart failure, angina and some dysrhythmias.
Adverse Reactions & Side Effects	Hypotension, tachycardia, bradycardia, nausea, vomiting and headache.
Contraindications	Heart block, hypersensitivity.
Implications	Check for edema, monitor renal function, blood and for symptoms of congestive heart failure.
Examples	• captopril • propranolol hydrochloride • reserpine • nitroprusside sodium

Anti-infectives

Anti-infective medications are used to treat a wide variety of bacterial infections. They inhibit the growth of bacteria by interfering with the production of certain biochemicals necessary to sustain the bacteria's life or by interfering with the bacteria's ability to use nutrients. The body's defenses then have a much easier time eliminating the infection.

When used properly, anti-infectives are usually effective. To treat an infection adequately, however, anti-infectives must be taken regularly for a specified time. If they are not taken for the prescribed period, microorganisms resistant to the medication may continue growing, and the infection could recur.

Anti-infectives are divided further into the following groups:

- penicillins
- cephalosporins
- aminoglycosides
- sulfonamides
- tetracyclines
- monobactam
- erythromycins
- quinolones

Actions	Inhibit the growth and/or replication of susceptible bacteria
Uses	Infection
Adverse Reactions & Side Effects	Diarrhea, nausea, vomiting, bone marrow depression and anaphylaxis (life threatening)
Contraindications	Hypersensitivity. Most people allergic to penicillins are also allergic to the cephalosporins.
Implications	Observe bowel pattern and urinary output. Monitor renal function, blood cultures and for signs of a superinfection and bleeding.
Examples	• penicillin • tetracycline

Antineoplastics

Antineoplastics or Anticancer drugs are the drugs that prevent or inhibit the maturation and proliferation of neoplasms. Antineoplastic agents travel the body and destroy cancer cells. Many of the side effects associated with antineoplastic agents occur because treatment destroys the body's normal cells in addition to cancerous cells. This classification is further divided into:

- alkylating agents
- antimetabolites
- antibiotic agents
- hormonal agents
- others

Actions	Alkylating agents - interfere with DNA. Antimetabolites - inhibit DNA synthesis. Antibiotic agents - inhibit RNA synthesis by delaying or inhibiting mitosis. Hormones - change the effects of androgens, estrogen, luteinizing hormone, and follicle-stimulating hormone.
Uses	Tumors, lymphoma, leukemia and Hodgkin's disease.
Adverse Reactions & Side Effects	Anemia, thrombocytopenia, leukopenia, nausea, vomiting, hair loss, hepatotoxicity, cardiotoxicity and hepatotoxicity.
Contraindications	Sensitivity, liver and renal damage.
Implications	Monitor blood studies (complete blood count (CBC), platelet count and differential (the drug may have to be held), renal and liver function, intake and output. Observe for bleeding, jaundice, dependent edema, breaks in the skin and mucosal inflammation. Check for irritation and phlebitis with IV administration.
Examples	• fluorouracil • cisplatin

Antiparkinson Agents

Antiparkinson drugs are medicines that relieve the symptoms of Parkinson's disease and other forms of parkinsonism. Parkinsonism is a group of disorders that share four main symptoms: tremor or trembling in the hands, arms, legs, jaw, and face; stiffness or rigidity of the arms, legs, and trunk; slowness of movement (bradykinesia); and poor balance and coordination. Parkinson's disease is the most common form of parkinsonism. All types of parkinsonism occur when nerve cells in a particular part of the brain die or lose the ability to function. These cells normally produce a chemical called dopamine, which helps relay signals to different parts of the brain. This process is important in producing smooth, coordinated movement throughout the body. When dopamine-producing cells are lost, normal movement becomes impossible. This classification is further divided into: cholinergics and dopamine antagonists.

Actions	Cholinergics- block acetylcholine receptors. Dopamine antagonists- activate dopamine receptors.
Uses	Parkinson’s Disease
Adverse Reactions & Side Effects	Involuntary movement, insomnia, nausea, vomiting, orthostatic hypotension, dry mouth, numbness and headache.
Contraindications	Sensitivity and narrow angle glaucoma.
Implications	Monitor respirations, blood pressure and changes in mental and behavioral status.
Examples	• levodopa • entacapone

Antipsychotic and Neuroleptic Agents

The antipsychotics have the capacity to sedate, tranquilize, blunt emotional expression, attenuate aggressive and impulsive behavior, and cause disinterest in the environment and lack of initiative. Unique features of the drugs are that higher intellectual functions are left relatively intact and yet they act to specifically ameliorate the agitation and bizarre behavior and thinking of psychotic patients. Unfortunately, no antipsychotic medication currently available even approaches what an ideal drug in this group should be.

Virtually all have prominent anticholinergic side effects and produce a wide variety of dystonias and extrapyramidal symptoms. Of greater concern is the fact that these agents cause tardive dyskinesia, a seriously disabling movement disorder that is often irreversible. Nonetheless, the antipsychotics, primarily used in schizophrenia, have reduced enormously the patient populations in mental hospitals and have allowed for maintenance in the community of chronic mentally ill patients who before the advent of neuroleptics would have been lifelong residents of hospitals. This classification is subdivided into groups of:

- phenothiazines
- thioxanthenes
- butyrophenones
- dibenzoxazepines
- dibenzodiazepines
- indolones
- other heterocyclic compounds

Actions	All of these pharmacological agents block the dopamine receptors in the brain, the area that involves psychotic behavior.
Uses	Schizophrenia, mania, paranoia, and anxiety. They are also sometimes used for unrelieved hiccups, nausea, vomiting, and pediatric behavioral problems as well as pre-operative relaxation.
Adverse Reactions & Side Effects	Some symptoms (extrapyramidal symptoms (EPS, dystonia, akathisia and tardive dyskinesia) can be controlled with antiparkinsonian medications. Others side effects include dry mouth, photosensitivity, agranulocytosis, hypotension, and life threatening cardiac problems and laryngospasm.
Contraindications	Coronary disease, severe hypertension, severe depression, bone marrow depression, blood dyscrasias, parkinsonism, cerebral arteriosclerosis, narrow angle glaucoma and children less than 12 years of age. Cautiously used with the elderly.
Implications	Monitor complete blood count (CBC), liver function, intake and output, blood pressure lying and standing (orthostatic hypotension), extrapyramidal symptoms (EPS) (antiparkinsonian agents should be used for this). Observe for dizziness, palpations, tachycardia, changes in affect, level of consciousness, gait and sleep patterns.
Examples	• haloperidol • chlorpromazine • Lithium

Antituberulars

These medications are used in the treatment and prevention of tuberculosis. Combinations are used in the treatment of active disease tuberculosis to rapidly decrease the infectious state and delay or prevent the emergence of resistant strains.

Actions	Decreases the replication of the offending bacillus through the inhibition of RNA or DNA.
Uses	Pulmonary tuberculosis.
Adverse Reactions & Side Effects	Anorexia, nausea, vomiting, rash, renal, hepatic and ototoxic effects, which could be severe.
Contraindications	Sensitivity, renal disease. Caution with hepatic disease, pregnancy and lactation.
Implications	Check renal and hepatic status and for signs of anemia.
Examples	• isoniazid • rifabutin • rifampin

Antitussives and Expectorants

These medications are used to treat cough and congestion such as with the common cold.

Actions	**Antitussives** - suppression of the cough reflex. **Expectorants** - decrease the viscosity of thick, tenacious secretions.
Uses	The expectorants are used with a cough associated with bronchitis, tuberculosis (TB), pneumonia, cystic fibrosis and chronic obstructive pulmonary disease (COPD). Antitussives are used for nonproductive coughs.
Adverse Reactions & Side Effects	Dizziness, drowsiness and nausea
Contraindications	Iodine sensitivity, pregnancy, lactation and hypothyroidism. Caution with the elderly and those with asthma.
Implications	Monitor the cough and the sputum. Increase fluid intake and humidification to thin secretions.
Examples	• guaifenesin • codeine

Antivirals

Antivirals are used to treat infections caused by viruses. Unlike antibacterial drugs, which may cover a wide range of pathogens, antiviral agents tend to be narrow in spectrum, and have limited efficacy.

Actions	Interferes with the DNA needed for viral replication.
Uses	HIV infections, herpes (herpes simplex virus and herpes genitalis), encephalitis (herpes simplex) and varicella zoster encephomyelitis, influenza.
Adverse Reactions & Side Effects	Nausea, vomiting, diarrhea, headache, anorexia, vaginitis, moniliasis, blood dyscrasias, renal failure and metabolic encephalopathy, which could be fatal.
Contraindications	Immunosuppressed patients with herpes zoster and hypersensitivity. Caution with pregnancy, lactation, renal and liver disease and dehydration.
Implications	Assess for renal and liver problems. Observe for signs of infection and allergic reactions (itching, rash, urticaria). Monitor the blood for dyscrasias.
Examples	• acyclovir sodium • cidofovir • Tamiflu

Barbiturates

Barbiturates are a class of drugs derived from barbituric acid that act as depressants to the central nervous system. These drugs are frequently used for medical reasons as sedatives or anesthetics.

Actions	Decreases impulse transmission to the cerebral cortex.
Uses	Epilepsy, sedation, insomnia, anesthesia, cholestasis with some medications in this classification.
Adverse Reactions & Side Effects	Drowsiness, nausea, blood dyscrasias and Stevens-Johnson syndrome.
Contraindications	Allergy, poor liver function, porphyria, pregnancy (category D). Caution with the elderly renal or hepatic disease (slowed metabolism).
Implications	Monitor seizure control, blood, hepatic and renal function. Observe for toxicity (insomnia, hallucinations, hypotension, pulmonary constriction; cold, clammy skin; cyanosis of lips, nausea, vomiting, delirium, weakness).
Examples	• phenobarbital • secobarbital

Benzodiazepines

Benzodiazepines are a class of drugs primarily used for treating anxiety, but they also are effective in treating several other conditions. The exact mechanism of action of benzodiazepines is not known. All benzodiazepines affect gamma-aminobutyric acid (GABA), a neurotransmitter chemical that nerves use to communicate with one another. Since scientists believe that excessive activity of nerves in the brain may be the cause of anxiety and other psychological disorders, and GABA reduces the activity of nerves in the brain, benzodiazepines may be working by increasing the effects of GABA in the brain and spinal cord.

Actions	Decreases anxiety by potentiating g-aminobutyric acid and other central nervous system inhibitory transmitters.
Uses	Anxiety secondary to phobic disorders and other conditions, acute alcohol withdrawal and pre-operative relaxation.
Adverse Reactions & Side Effects	Physical dependence and abuse, dizziness, drowsiness, orthostatic hypotension, and blurred vision.
Contraindications	Narrow angle glaucoma, infants less than 6 months old, hypersensitivity, lactation (diazepam) and liver disease (clonazepam). Caution with the elderly as well as those with renal and/or hepatic disease.
Implications	Monitor lying and standing blood pressure (notify MD if blood pressure drops 20 mm Hg or more), pulse, hepatic and renal function and signs of dependency. Administer with milk or food to prevent gastrointestinal symptoms.
Examples	• diazepam • clonazepam

Beta-adrenergic Blockers

Beta-blockers, also known as beta-adrenergic blocking agents, are medications that reduce blood pressure. Beta-blockers block the effects of the hormone epinephrine, also known as adrenaline. When one takes beta-blockers, the heart beats more slowly and with less force, thereby reducing blood pressure. Beta-blockers also help blood vessels open up to improve blood flow.

β-Blockers are divided into two categories:

- selective blockers
- nonselective blockers

Actions	Selective blockers - block the stimulation of b1-receptors in the cardiac smooth muscle with chronotropic and inotropic effects. Nonselective blockers - lowers blood pressure (plasma renins are reduced) without a reduction in heart rate or reflex tachycardia.
Uses	Hypertension, angina prophylaxis and ventricular dysrhythmias.
Adverse Reactions & Side Effects	Orthostatic hypotension, diarrhea, nausea, vomiting, bradycardia, blood dyscrasias, congestive heart failure (CHF) and bronchospasm.
Contraindications	Heart block, cardiogenic shock and congestive heart failure (CHF). Cautious use with the elderly and those patients with chronic obstructive pulmonary disease (COPD), coronary artery disease, asthma, renal disease, thyroid disease, pregnancy.
Implications	Monitor blood pressure, intake and output, daily weights, pulse and renal function. Observe for edema and take the apical and radial pulse before administration in order to determine if significant changes have occurred.
Examples	• Acebutolol (Sectral) • Atenolol (Tenormin) • Bisoprolol (Zebeta) • Metoprolol • Nadolol (Corgard) • Nebivolol (Bystolic) • Propranolol (Inderal LA)

Bronchodilators

Bronchodilators are medications that relax the bronchial muscles. Relaxing these muscles makes the airways larger, allowing air to pass through the lungs easier. This helps people with Chronic Obstructive Pulmonary Disease (COPD) breathe better. Many different kinds of bronchodilators are available. They can be grouped according to how long they work (called short- and long-acting drugs) or the way in which they widen or dilate the airways (beta-agonists, anticholinergics or theophyllines).

While all bronchodilators widen the airways, they work in different ways to do so. It is therefore possible to combine bronchodilators in order to achieve maximal benefit.

Many people with COPD experience constant breathing difficulty. Bronchodilators, therefore, need to be taken regularly to keep breathing under control, which is also known as *maintenance medication*. Conversely, *reliever medications* are used for temporary breathless. This classification is further subdivided into:

- anticholinergics
- α/β -adrenergic agonists
- β -adrenergic agonists
- phosphodiesterase inhibitors

Actions	Anticholinergics- inhibit the interaction of acetylcholine at receptor sites on bronchial smooth muscle. α/β -adrenergic agonists- increase the diameter of nasal passages and relax bronchial smooth muscle. β-adrenergic agonists- relax the smooth muscle of the bronchi. Phosphodiesterase inhibitors- increased smooth muscle relaxation in the respiratory system.
Uses	Asthma, bronchospasm, chronic obstructive pulmonary disease (COPD), emphysema, Cheyne-Stokes respirations.
Adverse Reactions & Side Effects	Dyspnea, bronchospasm, anxiety, tremors, throat irritation, nausea and vomiting.
Contraindications	Narrow angle glaucoma, severe cardiac disease, tachydysrhythmias and sensitivity. Cautious use with hypertension, seizure disorders, pregnancy and lactation, hyperthyroidism and prostatic hypertrophy.
Implications	Assess for a therapeutic response (absence of dyspnea and/or wheezing) and patient/family education about the use of the inhaler.
Examples	• albuterol • aminophylline

Calcium Channel Blockers

Calcium channel blockers are medications that inhibit calcium from entering cells of the heart and blood vessel walls. These medications relax and dilate the blood vessels, resulting in lower blood pressure and may also slow the heart rate and alleviate chest pain.

Actions	Inhibits the flow of calcium ions across the cell membrane of cardiac and vascular smooth muscle, thus relaxing the coronary vascular smooth muscle, dilating the coronary arteries, slowing SA/AV node conduction, and dilating peripheral arteries.
Uses	Angina, hypertension, and dysrhythmias.
Adverse Reactions & Side Effects	Dysrhythmias, edema, fatigue, headache, and drowsiness.
Contraindications	Systolic blood pressure of less than 90 mm HG, Wolff-Parkinson-White syndrome, 2nd or 3rd degree heart block, sick sinus syndrome, and cardiogenic shock. Congestive heart failure (CHF) may get worse in the presence of edema. Cautious use with hepatic and renal disease.
Implications	Monitor blood pressure, pulse and respirations. Administer at bedtime and before meals.
Examples	• verapamil • felodipine

Cardiac Glycosides

Cardiac glycosides represent a family of compounds that are derived from the foxglove plant (*Digitalis purpurea*). William Withering first described the therapeutic benefits of digitalis in 1785. Initially, digitalis was used to treat dropsy, which is an old term for edema. Subsequent investigations found that digitalis was most useful for edema that was caused by a weakened heart (*i.e.*, heart failure).

Actions	Cardiac output and cardiac contractility are enhanced by making more calcium available.
Uses	Congestive heart failure (CHF) and tachycardia.
Adverse Reactions & Side Effects	Cardiac changes, hypotension, gastrointestinal symptoms, blurred vision, yellowish-green halos and headache.
Contraindications	Hypersensitivity, ventricular fibrillation, ventricular tachycardia and carotid sinus syndrome. Caution among patients with imbalances of potassium, magnesium and/or calcium, acute myocardial infarction, severe respiratory disease, AV block, renal or liver disease, hypothyroid and the elderly.
Implications	Assess vital signs, check apical rate for one full minute prior to administration (if < 60, hold the dose and notify the physician), electrolytes (sodium, potassium, chloride and magnesium), renal and hepatic function. Monitor intake and output. For potassium level less than 3mg/dl, supplements may be ordered.
Examples	• digitoxin • digoxin

Cholinergics

Cholinergic drugs are any of various drugs that inhibit, enhance, or mimic the action of the neurotransmitter acetylcholine, the primary transmitter of nerve impulses within the parasympathetic nervous system — *i.e.*, that part of the autonomic nervous system that contracts smooth muscles, dilates blood vessels, increases bodily secretions, and slows the heart rate. Some cholinergic drugs, such as muscarine, pilocarpine, and are coline, mimic the activity of acetylcholine in stimulating the parasympathetic nervous system.

These drugs have few therapeutic uses. However, nicotine is one drug that has a principal addictive ingredient in the tobacco (used in cigarettes and cigars).

Other cholinergic drugs, such as atropine and scopolamine, inhibit the action of acetylcholine and thus suppress all the actions of the parasympathetic nervous system. They are used therapeutically to diminish salivation and bronchial secretions during anesthesia and to dilate the pupil during ophthalmological procedures.

Scopolamine is also used to treat motion sickness, an effect that depends on its ability to depress the activity of the central nervous system.

Actions	These medications prevent the destruction of acetylcholine, thus increasing its concentration, which enhances impulse transmission.
Uses	Myasthenia gravis, bladder distention, urinary distention, and postoperative paralytic ileus
Adverse Reactions & Side Effects	Bronchospasm, laryngospasm, respiratory depression, convulsion, paralysis, respiratory arrest, nausea, vomiting and diarrhea
Contraindications	Renal or intestinal obstruction. Cautious use with children, lactation, bradycardia, hypotension, seizure disorders, bronchial asthma, coronary occlusion, and hyperthyroidism.
Implications	Monitor vital signs, intake and output. Assess for urinary retention, bradycardia, bronchospasm, hypotension, respiratory depression.
Examples	• neostigmine • bethanechol

Cholinergic Blockers

Cholinergic blocking drugs interrupt parasympathetic nerve impulses in the central and autonomic nervous systems. These drugs are also referred to as anticholinergic drugs because they prevent acetylcholine from stimulating cholinergic receptors.

Actions	Blocks the autonomic nervous system's acetylcholine.
Uses	Prevention of surgical secretions, to decrease the motility of the urinary, biliary and gastrointestinal tracts, reverses neuromuscular blockade. Some are used for parkinsonian symptoms secondary to the use of neuroleptic medications.
Adverse Reactions & Side Effects	Constipation and dryness of the mouth.
Contraindications	Genitourinary or gastrointestinal obstruction, angle closure glaucoma, myasthenia gravis, and hypersensitivity. Cautious use among the elderly and with patients who have prostatic hypertrophy or tachycardia.
Implications	Monitor urinary status and intake and output with particular attention to any dysuria, frequency or retention. The medication may be discontinued with these signs. Observe mental status and for constipation. Administer oral doses with milk or food and administer parenteral doses slowly with the person in a recumbent position to prevent postural hypotension.
Examples	• atropine • scopolamine

Corticosteroids

Corticosteroids mimic the effects of hormones the body produces naturally in the adrenal glands, which sit on top of the kidneys. When prescribed in doses that exceed the body's usual levels, corticosteroids suppress inflammation. This can reduce the signs and symptoms of inflammatory

conditions, such as arthritis and asthma. Corticosteroids also suppress the immune system, which can help control conditions in which the immune system mistakenly attacks its own tissues. This classification is also subdivided. These groups are: glucocorticoids and mineralcorticoids.

Actions	**Glucocorticoids** - increase capillary permeability and suppress the movement of fibroblasts and leukocytes, thereby decreasing inflammation. **Mineralcorticoids** - increase potassium and hydrogen excretion in the distal tubule by increasing the resorption of sodium.
Uses	**Glucocorticoids** - decrease inflammation. Some are used for adrenal insufficiency, allergies and cerebral edema. **Mineralcorticoids** - adrenal insufficiency.
Adverse Reactions & Side Effects	Insomnia, euphoria, behavioral changes, peptic ulcer (gastrointestinal irritation), sodium and fluid retention, hypokalemia, hyperglycemia, and carbohydrate intolerance (metabolic reactions).
Contraindications	Fungal infections, amebiasis, hypersensitivity, and lactation. Caution with the elderly, children and pregnant women, diabetes, seizures, peptic ulcers, glaucoma, congestive heart failure (CHF), hypertension, impaired renal function, myasthenia gravis and ulcerative colitis.
Implications	Gastrointestinal symptoms can be prevented when the dose is given with food or milk. Monitor blood sugar, potassium, weight, intake and output, plasma cortisol levels, adrenal insufficiency and for any signs of infection. Observe for mood changes, particularly depression.
Examples	cortisone, dexamethasone, hydrocortisone, prednisone

Diuretics

Diuretics help rid the body of sodium and water. They work by making the kidneys put more sodium into the urine. The sodium, in turn, takes water with it from the blood. That decreases the amount of fluid flowing through the blood vessels, which reduces pressure on the walls of the arteries. This classification of medications is subdivided into:

- thiazides and thiazide-like diuretics
- loop diuretics
- carbonic anhydrase inhibitors
- osmotic diuretics
- potassium-sparing diuretics

Actions	**Thiazides and thiazide-like diuretics**- slow resorption in the distal tubule, thus increasing the excretion of sodium and water. **Loop diuretics**- inhibit the resorption of sodium and chloride in the loop of Henle. **Carbonic anhydrase inhibitors**- decrease the sodium-hydrogen ion exchange in the tubule, thus increasing sodium excretion. **Osmotic diuretics**- decrease the absorption of sodium by increasing the osmotic pressure of glomerular filtrate. **Potassium-sparing diuretics**- decrease potassium excretion by interfering with sodium resorption at the distal tubule.
Uses	Hypertension and edema with congestive heart failure (CHF).
Adverse Reactions & Side Effects	Hypokalemia, hyperglycemia and hyperuricemia (mostly with thiazides), blood dyscrasias, aplastic anemia, volume depletion, and dehydration (thiazides, loop diuretics, and carbonic anhydrase inhibitors).

Contraindications	Electrolyte imbalances (Potassium, Chloride, Sodium), anuria, dehydration. Caution among the elderly as well as in the presence of renal or hepatic disease.
Implications	A potassium supplement may be needed. Monitor electrolytes, blood sugar, and lying and standing blood pressures. Observe for signs of hypokalemia and metabolic alkalosis. The medication should be given in the morning to prevent the need for frequent nocturnal voiding.
Examples	• furosemide • hydrochlorothiazide

Histamine H2 Antagonists

H2-blockers work by decreasing the amount of acid produced by the stomach and are available both over-the-counter (OTC) and with a medical provider's prescription.

Actions	Inhibits histamine in the parietal cells, thereby inhibiting the secretion of gastric acid secretion.
Uses	Gastric and duodenal ulcers, gastroesophageal reflux disease.
Adverse Reactions & Side Effects	Thrombocytopenia, neutropenia agranulocytosis, aplastic anemia, confusion (not ranitidine), diarrhea and headache.
Contraindications	Hypersensitivity. Cautious use with children less than 16 years of age, hepatic or renal disease, organic brain syndrome, lactation and pregnancy.

Implications	Monitor intake and output, creatinine, blood urea nitrogen (BUN) and gastric pH. The pH should be maintained above 5. Give slowly IV over 30 minutes to avoid bradycardia and administer oral doses with meals to prolong the effect of the medication.
Examples	• cimetidine • ranitidine

Immunosuppressants

Immunosuppressant drugs, also called anti-rejection drugs, are used to prevent the body from rejecting a transplanted organ.

Actions	Inhibits lymphocytes.
Uses	Prevention of organ transplant rejection.
Adverse Reactions & Side Effects	Proteinuria, renal failure, albuminuria, hematuria, hepatotoxicity, oral Candida, gum hyperplasia, headache and tremors.
Contraindications	Hypersensitivity. Caution with severe hepatic or renal disease and pregnancy.
Implications	Monitor liver and kidney function, and drug blood levels. Observe for signs of hepatotoxicity, which can include itching, light colored stools, jaundice and dark urine. Administer with meals to avoid gastrointestinal symptoms.
Examples	• cyclosporine • azathioprine

Laxatives

Laxatives are used to treat and prevent constipation. This group is also subdivided as below:

- bulk products
- lubricants
- osmotics
- saline laxative stimulants
- stool softeners

Actions	Bulk laxatives - absorb water thus adding bulk to the stool. Lubricants - increase water retention in the stool. Stimulants - speed up peristalsis. Saline laxatives - pull water into the intestines. Osmotics - enhance peristalsis and increase distention. Stool softeners - reduce liquid surface tension within the bowel.
Uses	Constipation, as a bowel prep and a stool softener.
Adverse Reactions & Side Effects	Cramping, diarrhea, and nausea.
Contraindications	Megacolon, abdominal pain, nausea, vomiting, impaction, gastrointestinal obstruction or perforation, gastric retention and colitis. Caution with large hemorrhoids and rectal bleeding.
Implications	Monitor blood, intake and output, and urine electrolytes. Administer only with water to enhance absorption. Do not administer within one hour of taking an antacid, cimetidine or drinking milk.
Examples	psyllium, docusate sodium, magnesium hydroxide, mineral oil, bisacodyl

Neuromuscular Blocking Agents

Neuromuscular blocking agents bind to acetylcholine receptors post-synaptically and inhibit the action of acetylcholine. This blocks neuromuscular transmission and causes paralysis of the muscle. Neuromuscular blocking agents are used as an adjunct to anesthesia, only when artificial ventilation is available, to produce muscle relaxation in order to prevent movement of muscle during surgery or for certain critically ill patients. This classification is divided into:

- depolarizing blockers and
- nondepolarizing blockers

Actions	Inhibition of nerve impulse transmission.
Uses	The facilitation of endotracheal intubation and skeletal muscle relaxation (surgery, general anesthesia and mechanical ventilation).
Adverse Reactions & Side Effects	Apnea, respiratory depression, bronchospasm, and bradycardia.
Contraindications	Hypersensitivity. Cautious use with collagen, thyroid and cardiac disease, lactation, pregnancy, children less than two years of age, dehydration, electrolyte imbalances, and myasthenia gravis.
Implications	Monitor potassium and magnesium (imbalances may increase the action of this medication), vital signs every 15 minutes until recovery, and intake and output. IV doses must be given over 1 to 2 minutes by a person qualified and competent to do so (usually an anesthesiologist).
Examples	• gallamine • pancuronium

Nonsteroidal Anti-inflammatories

Nonsteroidal anti-inflammatories (NSAIDS) work by reducing the production of prostaglandins. Prostaglandins are chemicals that promote inflammation, pain, and fever. They also protect the lining of the stomach and intestines from the damaging effects of acid, and promote blood clotting by activating blood platelets. Prostaglandins also affect kidney function. The enzymes that produce prostaglandins are called cyclooxygenase (COX). There are two types of COX enzymes, COX-1 and COX-2. Both enzymes produce prostaglandins that promote inflammation, pain, and fever; however, only COX-1 produces prostaglandins that activate platelets and protect the stomach and intestinal lining. NSAIDs block COX enzymes and reduce production of prostaglandins. Therefore, inflammation, pain, and fever are reduced. Since prostaglandins that protect the stomach and promote blood clotting also are reduced, NSAIDs can cause ulcers in the stomach and intestines, and increase the risk of bleeding.

Actions	Decreases prostaglandin synthesis
Uses	Mild to moderate pain, arthritis and dysmenorrhea
Adverse Reactions & Side Effects	Blood dyscrasias, nephrotoxicity (oliguria, azotemia, hematuria and dysuria), abdominal pain, cholestatic hepatitis, anorexia, dizziness and drowsiness.
Contraindications	Asthma, severe liver and/or renal disease, hypersensitivity. Cautious use with the elderly, children, lactation, pregnancy and for patients with GI, cardiac and/or bleeding disorders.
Implications	Monitor blood, renal and hepatic function. Baseline hearing and eye exams are recommended so that changes can be identified. Toxicity may be signaled with tinnitus and/or blurred vision.
Examples	ibuprofen, naproxen.

Opioid Analgesics

Opioid drugs bind with the opioid receptors in the central nervous system to block the perception of pain or affect the emotional response to pain, including opium and its derivatives.

Actions	Depression of the pain impulse transmission at the level of the spinal cord.
Uses	Moderate to severe pain.
Adverse Reactions & Side Effects	Gastrointestinal (constipation, nausea, vomiting, anorexia, cramps), sedation, respiratory depression, circulatory depression and increased intracranial pressure.
Contraindications	Upper airway obstruction, bronchial asthma, hypersensitivity, addiction. Cautious use with renal, hepatic, respiratory and heart disease.
Implications	Monitor respiratory, urinary and mental status, level of consciousness. An antiemetic can be used for nausea and vomiting. Continue to assess level of pain.
Examples	• codeine • fentanyl • morphine • oxycodone

Salicylates

Salicylates may be used to lessen the chance of heart attack, stroke, or other problems that may occur when a blood vessel is blocked by blood clots. These medications help prevent dangerous blood clots from forming. However, this effect may increase the chance of serious bleeding in some people. Therefore, these drugs should be used for this purpose only when a medical provider decides, after studying the patient's medical condition and history, that the danger of blood clots is greater than the risk of bleeding.

Actions	Antipyretic (inhibits the heat regulation center in the hypothalamus), anti-inflammatory (inhibits prostaglandin), analgesic (inhibits prostaglandin).
Uses	Mild to moderate pain, inflammation (arthritis), fever, and thromboembolic disorders.
Adverse Reactions & Side Effects	Rash, gastrointestinal symptoms, hepatotoxicity, blood dyscrasias, hearing problems and tinnitus (a sign of possible toxicity).
Contraindications	Frequently occurring hypersensitivity. Contraindicated with a vitamin K deficiency, gastrointestinal bleeding, a bleeding disorder, children with Reye's syndrome. Caution with Hodgkin's disease, hepatic and renal failure, anemia.
Implications	Monitor renal and hepatic function, blood. Observe for signs of hepatotoxicity (clay colored stool, dark urine, diarrhea, yellow sclera and skin, itching, fever, abdominal pain) and ototoxicity (ringing or roaring in the ears, tinnitus).
Examples	• aspirin • salsalate

Thrombolytics

Thrombolytics are used to treat some people who are having a heart attack or stroke. They are typically given in a vein (intravenously, or IV). These drugs dissolve or break up blood clots that are blocking blood flow through an artery.

Actions	These medications convert plasminogen into plasmin which is able to break down the fibrin of clots.
Uses	Pulmonary emboli, deep vein and arterial thrombosis, with or after myocardial infarction (MI), arteriovenous cannula occlusion.
Adverse Reactions & Side Effects	Anaphylaxis, gastrointestinal , genitourinary , intracranial retroperitoneal bleeding, and anaphylaxis. The most common side effects are decreased Hematocrit, urticaria, headache, and nausea.
Contraindications	Hypersensitivity, people with central nervous system neoplasms, bleeding, renal or hepatic disease, hypertension, chronic obstructive pulmonary disease (COPD), subacute bacterial endocarditis, rheumatic valvular disease, cerebral embolism or thrombosis or hemorrhage, and recent surgery.
Implications	Monitor vital signs and neurological signs every 4 hours, be alert for internal bleeding (temperature of more than 104 degrees), arrhythmias, retroperineal bleeding (leg weakness, back pain, and poor pulses), allergic responses (rash, fever, itching, chill), ecchymosis, hematuria, hematemesis, epistaxis. Also, monitor blood before and during therapy. Thrombolytics are not effective if the thrombi are more than one week old. Use 0.8 mm filter with IV administration.
Examples	Streptokinase, urokinase

Thyroid Medications

Thyroid drugs are thyroid hormones used to treat hypothyroidism. They are used to supplement the natural thyroid hormones in the body. Thyroid drugs are used in treatment of low thyroid activity, treating or suppressing different types of goiters and for diagnosing certain thyroid conditions.

Actions	Increase metabolism cardiac output, blood volume, oxygen consumption, and respiratory rate.
Uses	Thyroid replacement.
Adverse Reactions & Side Effects	Palpitations, tachycardia, insomnia, tremors, angina, weight loss, dysrhythmias, thyroid storm.
Contraindications	Myocardial infarction (MI), adrenal insufficiency and thyrotoxicosis. Cautious use with the elderly, pregnant and lactating women, and for patients with diabetes, hypertension, angina, and cardiac disease.
Implications	Administer at the same time of day. Check the blood pressure before each dose. Monitor intake and output, weight, cardiac status and for irritability, excitability and nervousness.
Examples	• thyroid • levothyroxin

Vasodilators

Vasodilators are agents that widen the blood vessels therefore cause a decrease in vascular resistance and an increase in blood flow. They may act by activation of the vasomotor center in the brain, which brings about relaxation of the smooth muscle in the blood vessel walls or they can act locally on blood vessel smooth muscle cells.

Actions	Various modes for each. Check a drug reference book for specifics.
Uses	Hypertension, angina, intermittent claudication, vasospasm, arteriosclerosis.
Adverse Reactions & Side Effects	Both hypotension and hypertension, changes in EKG, nausea, headache.
Contraindications	Tachycardia, acute myocardial infarction and thyrotoxicosis. Cautious use with peptic ulcer and uncompensated heart disease.
Implications	Administer with meals to reduce any gastrointestinal symptoms. Check bleeding times and cardiac status.
Examples	• amyl nitrate • hydralazine

Summary

The topic of pharmacology is an important one for all involved in the field of healthcare. Medications have great power both to help and to harm patients. Having an understanding of the basics of pharmacology will allow clinicians to better serve their patients. This course has described the basic principles of pharmacology, pharmacokinetic processes including absorption, distribution, metabolism and excretion, as well as several drug classes and some of the commonly seen drugs within those classes.

Please take time to help NurseCe4Less.com course planners evaluate the nursing knowledge needs met by completing the self-assessment of Knowledge Questions after reading the article, and providing feedback in the online course evaluation.

Completing the study questions is optional and is NOT a course requirement.

1. **Pharmacokinetics is the branch of pharmacology that:**

   a. deals with determining the movement (kinetics) of drugs into and out of the body

   b. explains how drugs are manufactured

   c. addresses only the risks and benefits of medication

   d. answers b and c above

2. **Controlled medications are divided into _____ schedules based on their potential for abuse and physical and psychological dependence.**

   a. 3

   b. 4

   c. 5

   d. 7

3. **A medication will have a generic name and one or more trade names. The generic name:**

   a. usually signifies the medication's chemical derivation

   b. may either be determined by the company that first developed the drug, or a by the U.S. Adopted Name Council

   c. are written beginning with a lower case (small) letter

   d. all of the above

4. **True or False. Anticoagulants are a class of drugs commonly used to prevent the blood from forming dangerous clots.**

   a. True

   b. False

5. **True or False. Neostigmine and bethanechol are examples of cholinergic blockers.**

   a. True

   b. False

6. True or False. Long-acting anticholinergics are used to treat stable Chronic Obstructive Pulmonary Disease (COPD) in a person whose symptoms come and go (intermittent symptoms) whereas short-acting anticholinergics are effective and convenient to prevent and treat COPD in a person whose symptoms do not go away.

a. True.
b. *False.

7. Antineoplastics prevent or inhibit the maturation and proliferation of neoplasms. This classification is further divided into all of the following except:

a. alkylating agents
b. antimetabolites
c. *steroid agents
d. antibiotic agents

8. In the fasting state, most orally-administered drugs reach a maximum or "peak" blood concentration within _____ to _____ hours.

a. *one to two
b. two to three
c. three to four
d. six to twelve

9. Cardiac glycosides represent a family of compounds that are derived from the _____ plant.

a. hemp
b. *foxglove
c. cannibus
d. thymus

10. "Reliever medications" is a classification of medications used for temporary breathless, and is further subdivided into all EXCEPT:

a. anticholinergics

b. α/β -adrenergic agonists

c. β -adrenergic agonists

d. *β -adrenergic antagonists

11. β-Blockers are divided into two categories:

a. selective blockers

b. nonselective blockers

c. primary blockers

d. *Both a and b above

12. Antipsychotics produce a wide variety of dystonias and extrapyramidal symptoms, such as _____ a seriously disabling movement disorder that is often irreversible.

a. *tardive dyskinesia

b. akathesia

c. muscular rigidity

d. None of the above.

13. H2-blockers work by _____ the amount of acid produced by the stomach.

a. acting as proton pump inhibitors

b. *decreasing

c. neutralizing

d. Both a and c above.

14. True or False. Antiviral agents tend to be narrow in spectrum, and have limited efficacy.

a. *True

b. False

15. Loperamide is an

a. antihypertensive medication

b. *andiarrheal medication

c. antiarrhythmic medication

d. anti-inflammatory medication

16. Bradykinesia is

a. *slowness of movement

b. tetany

c. paralysis

d. tremoulous movement

17. Osmotic laxatives

a. soften stool.

b. *enhance peristalsis and increase distention.

c. pull saline into the intestines.

d. reduce the surface tension of liquids within the bowel.

18. Atropine and scopolamine

a. inhibit the action of acetylcholine.

b. suppress all the actions of the parasympathetic nervous system.

c. are used therapeutically to diminish salivation.

d. *All of the above.

19. A calcium channel blocker is a(n)

a. *antihypertensive

b. bronchodilator

c. antacid

d. anti-inflammatory

20. Alpha-blockers work by keeping the hormone norepinephrine (noradrenaline) from

a. relaxing the muscles in the walls of smaller arteries and veins.

b. *tightening the muscles in the walls of smaller arteries and veins.

c. relaxing the muscles in the walls of larger arteries and veins.

d. tightening the muscles in the walls of larger arteries and veins.

21. True or False. Class II antiarrhythmic drugs slow down the rate of SA node discharge and conduction through the AV node.

a. *True.

b. False.

22. Corticosteroids can reduce the signs and symptoms of inflammatory conditions, such as arthritis and asthma, and

a. suppress the immune system.
b. are subdivided into groups of glucocorticoids and mineralcorticoids.
c. mimic the effects of hormones.
d. *All of the above.

23. Antianginal drugs are divided into all EXCEPT

a. nitrates.
b. calcium channel blockers.
c. *alpha-blockers.
d. beta-adrenergic blockers.

24. Diuretics work by making the kidneys

a. *put more sodium into the urine.
b. remove sodium from the urine.
c. put more potassium into the urine.
d. All of the above.

25. Nadolol is an example of a(n)

a. Alpha blocker.
b. *Beta blocker.
c. Calcium channel blocker.
d. Anticholinergic.

26. True or False. The family of liver isoenzymes known as cytochrome P-450 are crucial to drug metabolism.

a. *True.

b. False.

27. Neuromuscular blocking agents is a drug classification divided into:

a. depolarizing blockers.

b. nondepolarizing blockers.

c. *Both a and b above.

d. None of the above.

28. Schedule I drugs have a

a. low potential for abuse.

b. *high potential for abuse.

c. include tylenol with codeine.

d. All of the above.

29. Phenytoin is an example of a(n)

a. antidepressant

b. *anticonvulsant

c. antipsychotic

d. antiemetic

30. Nonsteroidal anti-inflammatories (NSAIDS) work to

a. increase the production of prostaglandins.
b. *decrease the production of prostaglandins.
c. increase inflammation, pain, and fever.
d. affect liver function.

31. NSAIDs block

a. neuroreceptors
b. *COX enzymes
c. acid production
d. coagulation

32. True or False. NSAIDs protect the stomach from ulcers in the stomach and intestines.

a. True.
b. *False.

33. Amyl nitrate and hydralazine are examples of

a. *vasodilators
b. NSAIDs
c. loop diuretics
d. neuroleptics

34. GABA _____ the activity of nerves in the brain

a. increases.

b. *reduces.

c. has no effect on.

d. None of the above.

35. Antihistamines come in different forms, including

a. tablets/capsules.

b. liquid form.

c. nasal sprays/eye drops.

d. *All of the above.

36. True or False. Alpha-blockers can help improve urine flow in older men with prostate problems.

a. *True.

b. False.

37. Cyclosporine and azathioprine are examples of

a. antibiotic medication.

b. *immunosuppressant medication.

c. pain medication.

d. antihypertensive medication.

38. Thyroid supplements increase

a. metabolism.

b. cardiac output.

c. oxygen consumption.

d. *All of the above.

39. Neostigmine and bethanechol are examples of

a. *anticholinergics
b. analgesics
c. antihypertensives
d. antipsychotics

40. Isoniazid is an example of an

a. Antibiotic
b. NSAID
c. *antitubercular
d. antipsychotic

41. Adverse reactions of barbiturates can include

a. drowsiness
b. blood dyscrasias
c. Stevens-Johnson syndrome
d. *All of the above.

42. Nonselective beta blockers

a. *lower blood pressure.
b. increase heart rate.
c. increase blood pressure.
d. Both b and c above.

43. Peripherally acting antiadrenergics inhibit the release of norepinephrine thus decreasing

a. sympathetic vasodilation.
b. *sympathetic vasoconstriction.
c. autonomic response.
d. Both a and c above.

44. Some antacid combinations also contain simethicone, which may relieve symptoms of

a. hyperacidity.
b. inflammation.
c. *excess gas.
d. diarrhea.

45. Class 4 antidysrhythmics

a. increases SA node discharge.
b. *decreases SA node discharge.
c. increases calcium movement across the cell.
d. Both a and c above.

46. Glyburide is an example of a(n)

a. *antidiabetic medication.
b. antidiuretic medication.
c. antihypertensive.
d. thyroid supplement.

47. Sertraline, amitriptylyline and bupropion are examples of

a. antipsychotic medication.
b. *antidepressant medication.
c. sleeping medication.
d. pain medication.

48. Factors influencing drug metabolism include

a. genetics
b. environment
c. age
d. *All of the above.

49. Codeine is an example of a schedule _____ drug.

a. I

b. II

c. *III

d. IV

50. Systolic blood pressure of less than 90 mm HG, Wolff-Parkinson-White syndrome, and 2nd or 3rd degree heart block are all considered to be contraindications of

a. *calcium channel blockers.

b. antipsychotics.

c. antidiuretics.

d. None of the above.

Correct Answers:

1. a	11. d	21. a	31. b	41. d
2. c	12. a	22. d	32. b	42. a
3. d	13. b	23. c	33. a	43. b
4. a	14. a	24. a	34. b	44. c
5. b	15. b	25. b	35. d	45. b
6. b	16. a	26. a	36. a	46. a
7. c	17. b	27. c	37. b	47. b
8. a	18. d	28. b	38. d	48. d
9. b	19. a	29. b	39. a	49. c
10. d	20. b	30. b	40. c	50. a

References Section

The reference section of in-text citations include published works intended as helpful material for further reading. Unpublished works and personal communications are not included in this section, although may appear within the study text.

1. Drug Index A to Z. (n.d.) Drug information online. Retrieved November 3, 2012, from www.drugs.com
2. MedWatch: The FDA Safety Information and Adverse Event Reporting Program. (2012). Retrieved November 1, 2012, from http://www.fda.gov/Safety/MedWatch/default.htm.
3. Vallerand, A. H., Sanoski, C. A., & Deglin, J. H. (2012). Davis's drug guide for nurses. Philadelphia: F.A. Davis.
4. Kahn, G. M.I. (2015). Cardiac Drug Therapy. Totowa: Humana Press.
5. Vallerand, A. H., Sanoski, C. A., & Deglin, J. H. (2013). Davis's drug guide for nurses. Philadelphia: F.A. Davis
6. Aschenbrenner, D.S. (2013). Drug Therapy in Nursing. Philadelphia : Wolters Kluwer Health/Lippincott Williams & Wilkins.
7. George, S. (2012). Delmar Nurses' Drug Handbook. Clifton Park, N.Y. : Delmar/Cengage Learning.
8. Hudson, O.H. (2012). Drug information handbook : a comprehensive resource for all clinicians and healthcare professionals. Washington DC: LexiComp, American Pharmacists Association.

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