

## **Module 8**

### **PHARMACOLOGY REVIEW**

#### **INTRODUCTION**

This module is not intended as a substitution for a medication or drug handbook, but rather as a brief, overall review of medications. We strongly encourage you to acquire a current medication manual or handbook and to consult a current Physician's Desk Reference or pharmacology text, when working in the clinical setting to identify specific dosages, uses, side effects, and contraindications of current medications that patients are receiving.

Note that the medications listed in this module are identified by their generic names as well as some of their associated trade names. This is because physicians prescribing may use either format and the nurse needs to be familiar with both

#### **Unit 1**

##### **Antimicrobial Medications**

#### **AMINOGLYCOSIDES**

The antibiotics in this group are primarily used as bacteriocidal agents to treat aerobic gram-negative organisms, though they may be effective against some other organisms. Aminoglycosides are often used in combination with other antibiotics to treat massive infections.

Note that when given orally, the only effect they produce is sterilization of the bowel. Therefore, they must be given by IM or IV routes to achieve wide distribution throughout the body. The peak effect for the IV route is 30 minutes; for the IM route, 60 minutes. Aminoglycosides are administered generally every 8 to 12 hours. Peak and trough blood levels are often ordered to determine in Aminoglycosides are within a therapeutic level. Trough levels should be drawn one-half hour before the next dose and peak levels should be drawn one-half hour after the IV dose and one hour after IM dose.

Also note that this class of antibiotics carries a risk of nephrotoxicity and ototoxicity and should be used cautiously with any patient having a history of renal disease.

The signs and symptoms of ototoxicity include headache, vertigo, nausea and vomiting, tinnitus, and high frequency hearing loss. Nephrotoxicity signs and symptoms include cells and casts in the urine, oliguria, proteinuria, elevated serum creatinine, and elevated BUN.

The most commonly used Aminoglycosides are:

- Amikacin
- Gentamicin
- Kanamycin
- Netilmicin
- Streptomycin
- Tobramycin

#### **PENICILLIN**

Penicillins (PCNs) are now available in both natural and synthetic forms. Discovered in 1929 and commercially developed in 1941, the penicillins remain to this day one of the most important antibiotic

groups used to treat many common infections. The penicillins cover an extremely broad spectrum of effectiveness against a multitude of gram-positive and gram-negative organisms. Penicillinase or penicillin-resistant enzymes may block the effectiveness of some forms of penicillin, penicillinase-resistant penicillins have been developed to compensate for this.

The penicillins may be given in oral, IM, or IV doses, which produce immediate peak concentrations, are used when a serious infection requires rapid therapeutic effects and/or high concentrations of antibiotics. IM injections are used when oral doses are inconvenient or undesirable and when slow absorption over a longer period of time is desired. Traces of the antibiotic may be found 28 days following IM injection of some forms of penicillin. In general, oral and IV penicillins have a short half life which requires more frequent administration than many other types of antibiotics. On average, the duration of action is four to six hours.

Note: Some penicillins may inactivate aminoglycosides if given together. They should never be mixed in the same IV fluid, and as an added precaution, should be administered an hour or so apart when the patient is to receive both. Also, note that oral penicillin is most effective if administered on an empty stomach. Check with the patient prior to administering the medication to be sure that no known allergies currently exist. Penicillin given to an allergic patient can produce an anaphylactic reaction.

Some commonly used penicillin include:

- Ampicillin
- Amoxicillin
- Oxacillin
- Penicillin V
- Carbenicillin (exclusively IM or IV use)

## **CEPHALOSPORINS**

The cephalosporins are possibly the most frequently prescribed antibiotics. Bacteriostatic or bacteriocidal, they are classified in first, second, and third generation groupings according to their effectiveness against a particular organism. In general they are broad spectrum and one generation or another is usually effective against most gram-negative and gram-positive, aerobic and anaerobic bacteria. They are similar to the penicillins in structure and action, and the nurse should be aware that cross sensitivity may occur should a patient have a penicillin allergy. Only a few cephalosporins are effective when administered orally. Most are given parenterally. The nurse giving oral cephalosporins may reduce the side effects of nausea by giving the medication with food, but food will slow the absorption rate. IM injections of cephalosporins are generally painful and IV infusion should be done over a 30-minute period to reduce vein irritation. Super infection (overgrowth of unaffected organisms) may also occur, so assess for signs/symptoms of oral thrush or vaginitis. Complaints of diarrhea can be reduced by encouraging the patient to eat yogurt or drink buttermilk on a daily basis while taking the antibiotic. Cephalosporins should be used with care in patients with renal disease and may be nephrotoxic.

Some frequently used Cephalosporins include:

- Cefazolin (Ancef, Kefzol)—parenteral
- Cefoxitin (Mefoxin)—parenteral
- Ceftriaxone (Rocephin)—parenteral

- Cephalexin (Keflex)—oral use only
- Cefaclor (Ceclor)—oral use only

## TETRACYCLINES

Tetracyclines are a broad spectrum antibiotic group widely used for prophylactic treatment; however, tetracyclines are rarely considered the drug of choice for common infections because of the development of many resistant strains of bacteria. Tetracyclines are often given orally, sometimes by IV route, and rarely by IM injection because of poor absorption. There are also topical tetracycline ointments available for skin infections. Oral tetracycline absorption is reduced by milk products, many antacids, and iron preparations. Instruct the patient not to take the medicine with milk. Some forms of the tetracyclines should be taken on an empty stomach while others may be taken with food. Consult the drug handbook regarding the specific preparation ordered.

Note: Tetracyclines are not recommended for use in young children or pregnant women because they discolor tooth enamel. Advise patients to stay out of direct sunlight since photosensitivity is a common reaction. Also, gastrointestinal problems, vaginitis, and thrush may occur as a result of overgrowth of other resistant organisms. Tetracyclines can alter the results of numerous laboratory tests creating false positive readings, thus increasing or decreasing laboratory values. Consult a pharmacology textbook or drug manual for specific tests and possible alterations. Hepatotoxicity and nephrotoxicity may occur in some individuals, especially patients with renal disease.

Some frequently used tetracyclines include:

- Demeclocycline (Declomycin)
- Doxycycline (Vibramycin)
- Tetracycline Hydrochloride (Achromycin, Sumycin)

## SULFONAMIDES

Although the sulfonamides were the first group of effective systemic broad spectrum antibiotics developed, the evolution of many resistant bacteria have limited their use today. Sulfonamides are Bacteriostatic, thus preventing growth of susceptible organisms. They are primarily used in treatment of urinary tract infections. There are short, intermediate, and long-acting forms of these medications, consequently onset of action, peak effectiveness, and duration are widely variant depending on the specific medicine. For example, peak concentrations of some sulfonamides may occur within two hours while in others, peak action may be delayed as long as 17 hours. Most forms of sulfonamides are absorbed well. In oral preparations, foods may slow absorption, but not prevent it. It is important to give oral forms with at least eight (8) ounces of water and to encourage increased fluid intake.

Note: Nurses should know that patients taking digoxin, thiopental, methotrexate, or analgesics/anesthetics containing PABA may experience medication interactions with sulfonamides. Patients should also be advised to avoid direct sunlight.

Some frequently used sulfonamides include:

- Co-trimoxazole (Bactrim, Septa)
- Sulfisoxazole (Grantrisin)

## OTHER ANTIMICROBIAL AGENTS

Clindamycin is bacteriostatic, broad spectrum, and effective against many gram-positive and anaerobic organisms. The drug is reserved for use in serious infections only because of potentially lethal toxic effects.

Erythromycin is a relatively safe broad spectrum bacteriostatic antibiotic effective against gram-positive and gram-negative organisms. The drug of choice to treat Legionnaire's Disease, Erythromycin is available in oral and IV administration forms only. It is important to note that Erythromycin may interact with Theophylline.

Note: Do not crush tablets to dispense because gastric acid causes destruction of Erythromycin. The tablet has a protective coating to ensure that breakdown and absorption occur in the small intestine. The liquid suspension for children is suitably treated to prevent gastric deterioration and should be used for anyone unable to swallow pills.

Vancomycin is used to treat staphylococcus aureus antibiotic-resistant infections and intestinal infections caused by clostridium difficile. Vancomycin is given by IV administration only unless treating intestinal disease in which case an oral preparation is used.

Note: Watch for ototoxicity, infuse IV from over 60 minutes, and anticipate periodic monitoring of peak and trough Vancomycin serum levels.

Imipnem/Cilastatin is the broadest antibacterial spectrum yet and is only for parenteral use (this combination is always given together). Cilastatin does not have antibacterial properties, but it prevents renal tubules from hydrolyzing and making anti-microbial Imipenem ineffective.

Note: Do not give with Probenecid. Imipenem/Cilastatin may lower seizure threshold in susceptible patients. With prolonged use watch for super infection of resistant organisms.

## ANTITUBERCULAR MEDICATION

Isoniazid (INH) must be used in combination with other anti tubercular medication to prevent development of resistant organisms in active tuberculosis. INH may be used alone for prophylactic therapy in patients without active disease who have a positive skin test.

Rifampin is used in combination with INH or other antituberculin medicines.

Ethambutol Hydrochloride is often used in combination with both of the above drugs or when the organism shows particular resistance to the medication.

Note: When these medications are given in combination, there is an increased possibility that patients may experience central nervous system disturbances such as headaches, tremors, depression, anxiety, or confusion. Also, when INH is used, patients with seizure disorders who take phenytoin (dilantin) are more likely to develop symptoms of phenytoin toxicity.

**ANTIVIRAL AGENTS (COMMON)**

Zidovudine (AZT or Retrovir) is used in the treatment of AIDS or AIDS-related complex. Oral preparation is usually given in 200 mgm doses every four hours around the clock.

Note: The medication may cause significant reduction in red blood and white blood counts within a few weeks to a few months. You should monitor blood work carefully. There may be numerous incompatibilities with other medications including aspirin and acetaminophen.

Acyclovir (Zovirax) is used to treat herpes viruses. It may be given orally, IV, or topically applied.

Note: This medication may cause renal impairment, so watch for signs of nephrotoxicity.

## Unit 1 Self-Test

Match the description in Column B with the medication in Column A.

<u>Column A</u>	<u>Column B</u>
1. Aminoglycosides	a. may discolor tooth enamel in children
2. Penicillins	b. treat UTIs
3. Cephalosporins	c. Legionnaire's disease
4. Tetracyclines	d. Parenteral use only, broadest spectrum antibiotic
5. Sulfanamides	e. Gentamicin sulfate
6. Erythromycin	f. Ceclor
7. Imipenem/Cilastatin	g. Retrovir
8. Antitubercular Medicine	h. Nephrotoxic
9. Antiviral medicine	i. Rifampin
	j. rendered inactive when given too close to Gentamicin or Tobramycin

## Unit 2 Cardiovascular Medications

### CARDIAC GLYCOSIDES

Cardiac glycosides are digitalis preparations derived from the white foxglove plant and used primarily to treat congestive heart failure and dysarrhythmias. These medications affect the myocardium by increasing the force of the contraction and slowing the speed of conduction time, therefore reducing heart rate. They also have a mild diuretic effect.

Note: The therapeutic dosage range is narrow and you should observe closely for signs and toxicity which may include:

- visual disturbances such as blurred vision, spots, halos, flickering lights;
- neurologic disturbances such as headaches, depression, irritability, confusion, and seizures;
- cardiac complications such as bradycardia or tachycardia and other dysrhythmias;
- GI disturbances such as nausea, vomiting, or diarrhea.

Take an apical pulse before administering each dose to the patient and consult with physician before administering the medication if the pulse is below 60 beats per minute.

Frequently used cardiac glycosides include:

- Digoxin (Lanoxin)—orally or IV
- Digitoxin (Crystodigin)—orally or IV

## ANTIDYSRRHYTHMIC MEDICATIONS

Antidysrhythmic medications are used in the prevention and treatment of atrial and ventricular dysrhythmias. They are divided into numerous classifications according to action.

### Group I

IA—This group reduces automaticity (activity of pacemaker cells) and increases conduction time by reducing the amount of sodium ( $\text{Na}^+$ ) that is allowed to pass through the myocardial cell membrane. Commonly used medications include Disopyramide phosphate (Norpace), Procainamide hydrochloride (Procan SR, Pronestyl), and Quinidine (Quinidex, Quinaglute).

Note: These can cause congestive heart failure (CHF) in susceptible patients and may cause confusion in elderly patients.

IB—This group is used to treat ventricular dysrhythmias. They particularly affect Purkinje fibers and ventricular myocardial cells to suppress premature beats. A commonly used medication is Lidocaine (Xylocaine).

Note: GI distress is common, as are central nervous system (CNS) disturbances. Medication may be contraindicated in patients with heart block or with a history of hypersensitivity to local anesthetics. Further, the medicine Phenytoin (Dilantin) resembles class IB antiarrhythmias in action when it is given IV push.

IC—These drugs are oral medications used to treat ventricular dysrhythmias. They have many very serious side effects and are given with extreme caution. Examples of drugs in this class include Flecainide acetate (Tambocor) and Encainide HCl (Enkaid).

Note: These medications may increase congestive heart failure or actually cause arrhythmias. Cardiac monitoring is advisable during adjustment of medication level and always during initial therapy.

### Group II

Group II are beta-adrenergic blockers that slow the automaticity of SA node, slow conduction of the AV node, and reduce oxygen demands of the myocardial tissue. A common medication is Propranolol HCl (Inderal).

### Group III

Group III medications are used to treat ventricular dysrhythmias. They are not usually the first choice for therapy because of serious and sometimes unpredictable reactions. Bretylium (Bretylol) administered IM or IV is an example.

### Group IV

Group IV medications are known as calcium channel blockers. They slow the movement of calcium into myocardial cells and therefore slow SA node impulses and delay AV node transmission. Verapamil (Calan) is an example.

## ANTIANGINAL MEDICATIONS

Some antianginal medications cause vasodilation of coronary vessels, increase the oxygen supply to the myocardium and/or reduce myocardial oxygen demand. Some are nitrates, some are channel blockers, and some are beta adrenergic blockers. A few have no classification. Some of these medications have already been mentioned for their antiarrhythmic effects as well.

Frequently used antianginal medications include:

1. Nitrates: Nitroglycerin (Nitro-Bid, Nitrostat)—sublingual, IV, topical routes;

Isorsorbid (Isordil)—sublingual, oral routes.

Note: Common reactions include headaches and occasionally postural hypotension.

2. Beta-Blockers: Propranolol (Inderal)  
Metoprolol Tartrate (Lopressor)  
Nadolol (Corgard)  
Atenolol (Tenormin)

Note: Give these with caution to patients with diabetes, chronic obstructive pulmonary disease, or congestive heart failure. Check apical pulse and blood pressure before giving and consult with physician before administering if pulse rate is below 60 beats per minute or systolic blood pressure is below 90 mm.

3. Calcium Channel Blockers: Verapamil HCl (Calan)  
Nifedipine (Procardia)  
Diltiazem HCl (Cardizem)

Note: Give with caution to patients with liver or renal disease, congestive heart failure, and some conduction disorders. Check apical pulse and blood pressure and notify physician if pulse rate is below 60 beats per minute and systolic blood pressure is below 90 mm.

4. Unclassified: Dipyridamole (Persantine)

Note: This causes coronary vessels to dilate. Give orally one hour before meals.

## ANTIHYPERTENSIVE MEDICATIONS

Antihypertensive medications are used to regulate blood pressure. According to the World Health Organization, hypertension exists when the systolic blood pressure is 160mm or higher and the diastolic blood pressure is 95mm or higher. In the milder forms (lower ranges) of hypertension, medication therapy may not be necessary if hypertension can be controlled with weight loss, elimination of smoking, and reduction of excess sodium consumption. When the blood pressure continues to remain elevated or rises further, medications are often indicated to prevent organ damage. The groups of antihypertensives that may be used included sympathetic, vasodilators, and angiotension antagonists. Diuretics will be discussed later in the section dealing with regulation of fluid and electrolyte balance.



## Unit 2 Self-Test

1. Visual disturbances and cardiac complications are among signs of toxicity from cardiac glycosides. Specifically, what signs/symptoms should the nurse observe for?
2. Name a cardiac glycoside.
3. What medicine affects Purkinje fibers to suppress premature heart beats?
4. What medicine reduces Na<sup>+</sup> passing through myocardial cells?
5. Name a common beta-adrenergic blocker.
6. Name a common calcium blocker.
7. What are two common side effects of antianginal medications?
8. Lopid, Atromid, and Questran are examples of what type medication?
9. Name three antihypertensive medications that are vasodilators.
10. What three behaviors are helpful in controlling hypertension?

## Unit 3 Central Nervous System Medications

### NON-NARCOTIC ANALGESICS AND ANTIPYRETICS

Many central nervous system medications—**non-narcotic analgesics** and **antipyretics**—are commonly used and readily available as over-the-counter preparations. Their onsets, peak levels, and durations vary depending on the preparation and the routes of administration. Some of the types of medication include salicylates, acetaminophen, and urinary tract anesthetics.

Frequently used medications include:

- Aspirin—the most frequently used salicylate
- Diflunisal (Dolobid)
- Acetaminophen (Tylenol, Panadol)
- Phenazopyridine HCl (Pyridium)

Note: Watch for symptoms of salicylate toxicity which include tinnitus, GI disturbances, and bleeding tendencies. High doses or toxic effects of acetaminophen may result in liver and renal damage. Phenazopyridine normally turns urine bright orange.

## **NON-STEROIDAL ANTIINFLAMMATORY MEDICATION**

These drugs are analgesics which have an antipyretic anti-inflammatory effect without the GI side effects of aspirin. It may take several weeks of therapy for the medication to achieve the full anti-inflammatory effect.

Frequently used non-steroid anti-inflammatory medications include:

- Ibuprofen (Advil, Motrin)
- Indomethacin (Indocin)
- Naproxen (Naprosyn)
- Piroxicom (Feldene)
- Sulindac (Clinoril)

## **NARCOTIC ANALGESICS AND NARCOTIC ANTAGONISTS**

These drugs come under federal law which requires that narcotic medications be strictly controlled. All narcotics must be stored in a double locked container. Careful records must be kept of available supplies, use and/or waste of each dosage of every medication. The medications work by binding with opiate receptor sites in the central nervous system to reduce pain. They also alter the patient's perception of and response to the pain.

Frequently used narcotic analgesics include:

- Morphine Sulfate
- Meparidine (Demerol)
- Codeine
- Oxycodone plus aspirin (Percodan)
- Oxycodone plus Acetaminophen (Percocet)
- Propoxyphene (Darvon)

Note: Watch for adverse reactions of respiratory depression and postural hypotension. Pupillary constriction is to be expected.

Frequently used narcotic antagonists include:

- Naloxane (Narcan)

Note: Narcotic antagonists reverse the respiratory depression and the sedative effects of narcotics. They are used in the treatment of narcotic overdose.

Narcotic antagonists combined with narcotics have an effect somewhat like morphine in producing pain relief, but with less likelihood of respiratory depression and dependency. These may be used for obstetric analgesia.

Frequently used combined narcotics and narcotic antagonists are:

- Butorphanol tartrate (Stadol)
- Pentazocine (Talwin)

## SEDATIVES

Sedatives are used to produce a calming, often drowsy effect. In larger doses they result in sleep and are known as **hypnotics**. Because of this effect, these medications are often used to treat insomnia. The categories of these medications include barbiturates, benzodiazepines, and other sedatives.

Frequently used barbiturates include:

- Secobarbital (Seconal)
- Phenobarbital (Luminal)
- Pentobarbital (Nembutal)

Note: Use of barbiturates over time may cause physical and psychological dependence. A “hangover” effect of drowsiness, impaired motor skills, and judgment frequently occurs following use of a barbiturate.

Frequently used benzodiazepines include:

- Flurazepam (Dalmane)
- Lorazepam (Ativan)
- Temazepam (Restoril)
- Triazolam (Halcion)

Frequently used sedatives/hypnotics that are non-barbiturate and non-benzodiazepine are:

- Chloral Hydrate (Noctec)
- Ethchlorvynol (Placidyl)

Note: With all sedatives/hypnotics, patients should be warned that sedatives increase the effects of alcohol and that driving and other potentially hazardous activities should be avoided.

## ANTICONVULSANTS

These drugs are used to reduce or prevent seizure activity. The type of seizure the patient suffers will determine which medication or combination of medications will be useful.

Note: It may take several weeks of medication therapy before therapeutic blood levels are attained. Consumption of alcohol or over-the-counter drugs should generally be avoided because of possible interaction with the anticonvulsant medicines. Patients need to be aware that suddenly discontinuing their medication may precipitate seizures, so prescriptions should be renewed faithfully. Also, patients taking anticonvulsants should be taught the importance of ongoing medical follow-up care.

Frequently prescribed anticonvulsants include:

- Phenytoin (Dilantin)
- Mephenytoin (Mesantoin)
- Phenobarbital (Luminal)
- Primidone (Mysoline)
- Carbamazepine (Tegretol)
- Clonazepam (Klonopin)
- Diazepam (Valium)
- Valproate Sodium (Depakene)
- Magnesium Sulfate

### **ANTIDEPRESSION AND ANTIMANIC MEDICATIONS**

These medications are used to treat disorders such as depression, mania, and alternating mood swings of both mania and depression. It usually takes several weeks for therapeutic blood levels to be attained and, likewise, it may take several weeks following discontinuation of these medications for all traces to disappear from the blood. The antidepressants are usually divided into four groups known as Monoamine oxidase (MAO) inhibitors, tricyclic antidepressants, second generation antidepressants, and selective serotonin reuptake inhibitors (SSRI).

Frequently used MAO inhibitors include:

- Isocarboxazid (Marplan)
- Traxylcypromine (Parnate)

Note: Orthostatic hypotension is a common side effect, however, hypertension crisis may occur if patients on these medications eat food containing high levels of the enzyme tyramine. (Consult drug reference book for list of foods to be avoided.)

Frequently used tricyclic antidepressants are:

- Amitriptyline (Elavil)
- Doxepin (Sinequan)

Note: Orthostatic hypotension is a common side effect. Also, the tricyclics may interact adversely with MAO inhibitors. Patients on tricyclics should avoid alcohol.

Frequently used second generation antidepressants include:

- Maprotiline (Ludiomil)
- Trazodone (Desyrel)
- Bupropion (Wellbutrin)

Note: All four types of antidepressants may produce drowsiness and patients should be cautioned about driving.

Frequently used SSRIs include:

- Paroxetine (Paxil)
- Fluoxetine (Prozac)

Note: An often overlooked side effect of SSRIs is sexual dysfunction. As many as 20% to 40% of clients may suffer from loss of libido, erectile dysfunction, ejaculatory dysfunction, or anorgasmia.

Frequently used antimania medication includes:

- Lithium (Eskalith, Lithone, Lithabid)
- Anticonvulsants (Depakote, Tegretol)

Note: The therapeutic range is very narrow. Patients need close monitoring of serum lithium levels. Interaction with other medications may affect Lithium serum concentrations.

## **TRANQUILIZERS**

Tranquilizers are used to reduce anxiety, for example, in preoperative patients, patients suffering from anxiety disorders, or patients being treated for alcohol withdrawal. They also may be useful in producing skeletal muscle relaxation and as anticonvulsant agents. Long term use can produce dependence; therefore, these drugs should be prescribed with caution.

Frequently used tranquilizers include:

- Alpraxolam (Xanax)—also has a mild antidepressant effect
- Chlordiazepoxide (Librium)
- Chlorazepate (Tranxene)
- Diazepam (Valium)
- Lorazepam (Ativan)
- Oxazepam (Senax)
- Buspirone (Buspar)

Note: Nurses should warn patients that drowsiness may occur and to avoid alcohol. Thus far, studies on Buspirone demonstrate no evidence of abuse potential and no interaction with alcohol (unlike the other tranquilizers).

## **ANTIPSYCHOTIC MEDICATIONS**

These drugs are used to treat symptoms of psychotic disorders. They decrease paranoid behaviors, hallucinations, delusions, agitation, and autism. Even though there are serious side effects from these medications, they have many beneficial effects in the treatment of patients with acute or chronic mental illness. Their use has enabled patients with severe mental disorders to lead functional lives in the community, to respond to psychotherapy, and to reduce the need for psychiatric hospitalization. It usually takes several weeks of medication therapy for blood levels to attain an effective therapeutic range.

A few examples of currently used antipsychotic medications include:

- Chlorpromazine (Thorazine)
- Fluphenazine deconoate (Prolixin)
- Haloperidol (Haldol)
- Thiothixene (Navane)
- Risperidone (Risperdal)
- Ziprasidone (Geodon)

Note: Sedation may occur as well as photosensitivity. Therefore, you should caution patients against driving and direct sunlight exposure. Watch closely for adverse reactions such as extrapyramidal effects; for example, parkinsonian-like behaviors: tremors, muscle spasms involving the face and neck, restlessness, or abnormal uncontrolled motor activity.

## **CEREBRAL STIMULANTS**

Cerebral stimulants stimulate the central nervous system and may be used to treat narcolepsy, attention deficit disorders, and respiratory depression. They have also been used to treat obesity. Many of these medications are federally controlled substances with a significant potential for abuse; they should be prescribed and dispensed with caution. Some are classified as amphetamines. Others are non-amphetamines which produce similar effects to amphetamines. Others are central nervous system and/or respiratory stimulants.

A few examples include:

- Amphetamine sulfate (Benzedrine)
- Fenfluramine (Pandimin)—a non-amphetamine
- Methylphenidate (Ritalin)—in children, it produces a calming effect rather than stimulation
- Doxapram (Dopram)
- Ammonia, Aromatic spirits

**Unit 3  
Self-Test**

Match the description in Column A with the drug in Column B.

Column A

1. Non-narcotic analgesic, antipyretic
2. Non-steroidal anti-inflammatory
3. Side effects include tinnitus and bleeding tendencies
4. Narcotic analgesic
5. Narcotic antagonist
6. Sedative
7. Should not discontinue medicine suddenly
8. Should avoid eating foods that contain tyramine
9. Tranquilizer whose long term use produces dependence
10. Stimulant that produces a calming effect on children

Column B

- a. Oxycodone
- b. Dilantin
- c. Aspirin
- d. Naproxan (Naprosyn)
- e. Marplan
- f. Diazepam
- g. Haloperidol
- h. Narcan
- i. Lorazepam (Ativan)
- j. Benzedrine
- k. Ritalin

## Unit 4 Autonomic Nervous System (ANS) Medicines

### CHOLINERGICS

Cholinergics (parasympathomimetics) facilitate the action of acetylcholine, the neurotransmitter mimicking the effects of parasympathetic nerve stimulation. They are primarily used in the treatment of an atonic GI tract and urinary bladder, thus promoting increased peristalsis and sphincter relaxation respectively; in diagnosing and treating myasthenia gravis; and in treating glaucoma by reducing intraocular pressure. They also affect the heart rate and cause increased salivary gland secretion as well as constriction of the bronchioles.

Some examples of commonly prescribed cholinergics include:

- Bethanechol (Urecholine) – GI & GU use
- Metaclopramide HCl (Reglan) –GI use
- Neostigmine (Prostigmin) –myasthenia gravis into increased muscle contractions
- Pilocarpine (Pilocar) –Glaucoma

### CHOLINERGIC BLOCKERS

Cholinergic Blockers (parasympatholytics/anticholinergics) block the action of acetylcholine and therefore, block parasympathetic nerve impulses. They have the opposite effect of cholinergics. They increase pupillary dilation; decrease secretions of the salivary gland, respiratory, and GI tracts; cause bronchial dilatation; increase heart rate; decrease GI peristalsis; and increase urinary retention. They also are used to treat Parkinsonian and pseudoparkinsonian symptoms.

Some common examples of anticholinergics include:

- Atropine sulfate
- Benztropine mesylate (Cogentin) –Antiparkinsonian effect
- Dicyclomine (Bentyl, Antispas)
- Scopolamine (Transderm Scop) –motion sickness
- Tribexyphenidyl HCl (Artane) –Antiparkinsonian effect

Note: These medications are to be used with caution as they may have multiple interactions with other medications. See a drug handbook regarding specific medications.

### ADRENERGICS

Adrenergics (sympathomimetics) stimulate the Sympathetic nervous system that controls involuntary muscle action. Most mimic the effects of epinephrine and nor-epinephrine. Some act on dopamine receptors. These medications may cause cardiac stimulation, vasoconstriction, bronchodilatation, smooth muscle and uterine relaxation, and occasionally, peripheral vasodilatation. A number of the adrenergics are used in emergent situations to treat hypotension, shock, respiratory distress, and cardiac arrest.

Some examples of commonly used adrenergics include:

- Dobutamine (Dobutrex)
- Dopamine (Intropin)
- Epinephrine (Adrenaline, Susphrine, Primatene Mist)
- Isoproterenol (Isuprel)
- Albuteral (Proventil)
- Metaproterenol (Alupent, Metaprel)
- Ritodrine (Yutopar) –uterine relaxation
- Terbutaline (Brethine)

Note: Consult drug handbook for information related to specific medications. Incompatibilities and interactions of medicines as well as adverse effects may be profound. Monitor patients carefully.

### **ADRENERGICS BLOCKERS**

Adrenergics blockers (sympatholytics) block sympathetic nervous system function. Depending on the site affected, they may be alpha, beta, or autonomic ganglionic blockers. These medications may be used to treat vascular headaches; spastic peripheral vascular disease; and hypertension.

Some examples of adrenergic blockers include:

- Alpha blockers:       Ergoliod mesylate (Hydergine)  
                                  Ergotamine tartrate (Ergostat)
- Beta blockers:         Atneol (Tenormin)  
                                  Metoprolol tartrate (Lopressor)  
                                  Nadolol (Corgard)  
                                  Propranolol (Inderal)
- Autonomic gaglionic  
  Blockers:                Trimethaphan (Arfonad)

Note: Watch closely for cardiovascular adverse reactions such as sever hypotension and/or dysrrhythmias.

### **SKELETAL MUSCLE RELAXANTS**

These drugs are used to relieve muscle spasms and/or spasticity. A few of the conditions that may respond to muscle relaxants include acute musculoskeletal injury, cerebral palsy, spinal cord injury, and cerebrovascular accident (CVA).

A few examples of commonly used muscle relaxants include:

- Carisoprodol (Soma)
- Cyclobenzaprine (Flexoril)
- Dantrolene (Dantrium)
- Diazepam (Valium)

- Baclofen (Lioresal)

Note: You should warn patients that these medications may cause drowsiness and that they should avoid alcohol and other central nervous system depressants.

## **NEUROMUSCULAR BLOCKERS**

These drugs also relax skeletal muscles to a state of paralysis, yet they will not render the patient unconscious or free of pain. They are most often used in administration of surgical anesthesia. Because respiratory muscles are affected, mechanical ventilation is necessary for patients receiving these medications. They are almost always given by an anesthesiologist.

Some examples of neuromuscular blockers include:

- Pancuronium (Pavulon)
- Tubocurarine (Tubarine)
- Succinylcholine (Anectine)

**Unit 4  
Self-Test**

1. Cholinergic medications may cause bronchial constriction.
  - a. True
  - b. False
  
2. Uses of cholinergics include
  - a. Increase intestinal peristalsis
  - b. Urinary sphincter relaxation
  - c. Increase intraocular pressure
  - d. Diagnosis of myasthenia gravis
  
3. Name three commonly used cholinergics.
  
4. Uses of cholinergic blockers include
  - a. Decrease secretions of GI and Respiratory tracts.
  - b. Decrease GI peristalsis.
  - c. Decrease Parkinsonian symptoms.
  - d. Papillary constriction.
  - e. Decrease heart rate.
  
5. Adrenergics may cause the following effects
  - a. Cardiac stimulation.
  - b. Bronchoconstriction.
  - c. vasoconstriction.
  - d. uterine relaxation.
  
6. Examples of adrenergic medicines are
  - a. Dobutamine (Dobutrex), Dopamine (Intropin).
  - b. Ritodrine (Yutopar), Albuteral (Preventil).
  - c. Propranolol (Inderol), Ergotamic (Ergostat)
  - d. Isoproterenol (Isoprel), Atenolol (Tenormin)
  
7. Adrenergic blockers (sympatholytics) may cause serious cardiovascular reactions such as nerve hypotension and dysrhythmias.
  - a. True
  - b. False
  
8. Neuromuscular blockers, like Anectrine, may be given to reduce muscle spasm or spasticity in cerebral palsy.
  - a. True
  - b. False
  
9. Patients should be cautioned that skeletal muscle relaxants may cause drowsiness.
  - a. True
  - b. False

## Unit 5 Respiratory Tract Medications

### ANTI-HISTAMINES

These drugs block the effect of histamine, a substance released by the body during an allergic response which may produce symptoms such as rhinitis, conjunctivitis, urticaria, and pruritis. Antihistamines are used to treat these symptoms, and also on occasion, to treat the symptoms of motion sickness or insomnia.

Some examples of antihistamines include:

- Dimenhydrinate (Dramamine)
- Diphenhydramine (Benadryl, Caladryl, Nytol)
- Promethazine (Phenergan)
- Terfenadine (Seldane)

Note: Drowsiness is a common reaction. Be sure to counsel patients to avoid alcohol and other central nervous system depressants.

### BRONCHODILATORS

Bronchodilators are used to relax bronchial smooth muscles and to treat respiratory diseases such as bronchitis, emphysema, and asthma. Bronchodilators also have a diuretic effect and act as a cardiac stimulant. Theophylline and its derivatives comprise the drug classification known as the methylxanthine agents.

Examples of the Theophyllines include:

- Anhydrous Theophylline (Theo-Dur, Slo-Bid)
- Aminophylline (Somaphyllin)
- Dyphylline (Lufyllin)

Note: Reactions may include central nervous system responses such as irritability, anxiety, or headache; GI distress; tachycardia; and hypotension.

### EXPECTORANTS, ANTITUSSIVES, AND MUCOLYTICS

Expectorants induce expectoration by decreasing viscosity of sputum through increasing or liquifying secretions. Antitussives, on the other hand, suppress the coughing mechanism. Mucolytics decrease viscosity of mucus by changing the composition of mucous molecules.

Some examples of commonly used expectorants are:

- Potassium iodide (SSKI)
- Guaifenesin (Robitussin)

Some examples of antitussives are:

- Codeine sulfate—a narcotic
- Dextromethorphan Guaifenesin—(Robitussin DM)
- Hydrocodone bitartrate (Hycodan)—a narcotic
- Diphenhydramine (Gendaryl, Benylin)

Some example of mucolytic agent is:

- Acetylcysteine (Mucomist)

Note: Narcotic antitussives may be addicting and should not be used for prolonged therapy. They also should not be taken in combination with other central nervous system depressants. Neither should they be used by patients with emphysema, as they may lead to increased viscosity of mucous and loss of the cough reflex.

## Unit 6 Gastrointestinal Tract Medications

### ANTACIDS, ABSORBANTS, & ANTIFLATULENTS

Antacids are medicines that neutralize gastric acids on contact and are used in the treatment of peptic ulcer disease. Antacids are available as non-prescription medicines and indiscriminate self-medication is not uncommon.

Some common examples of antacids include:

- Magnesium hydroxide and aluminum hydroxide with simethicone (Mylanta II, Gelusil II, Maalox II)
- Magaldrate (Riopan) –combined magnesium and aluminum hydroxide
- Calcium carbonate (Tums)

Note: Constipation is a common reaction. Other medications should always be taken/administered an hour or so after antacids because antacids interfere with medication absorption. Antacids containing aluminum should not be used when patients have renal disease as their inability to excrete this metal may lead to excess accumulation in the bones, nerve, and lung tissues leading to osteomalacia and dementia. Calcium and magnesium containing antacids are also contraindicated for patients with severe renal disease.

Absorbants are antidotes used to absorb toxic chemicals that have been ingested. They are excreted via feces. The most common example of an absorbent is activated charcoal (Charcocaps, Digestalin).

Note: Although effective against many toxic substances, activated charcoal is not effective for very poisoning. For example, it is ineffective in treating cyanide, mineral acids, or alkali poisoning. Do not mix with dairy products or give within an hour of other medications.

Antiflatulents relieve gas in the GI tract. An example is Simethicone (Mylicon).

## **GASTROINTESTINAL ANTI-CHOLINERGICS**

These drugs slow down GI smooth muscle contractions and gastric emptying and reduce gastric acid secretion. They may be used in treatment of peptic ulcer disease.

A few commonly prescribed GI anticholinergics are:

- Propantheline bromide (Probanthine)
- Dicyclomine HCl (Antispas, Bentyl)

## **HISTAMINE –2 RECEPTOR ANTAGONISTS**

These drugs block acid secretion particularly at the histamine receptor sites of the parietal cell in the stomach. These are among the most frequently prescribed medications for the treatment of ulcer disease.

Frequently prescribed H-2 Receptor Antagonists include:

- Cimetidine (Tagamet)
- Ranitidine (Zantac)
- Famotidine (Pepcid)

Note: Do not give antacids if ordered within an hour of administering these medicines as the antacids may diminish the effectiveness of the H-2 Receptor Antagonists. Cimetidine, especially, may cause confusion in elderly patients.

## **SUCRALFATES**

Sucralfates bind directly to the ulcer surface creating a protective barrier and are used to treat duodenal ulcer diseases. Sucralfate (Carafate) is an example of this type of medication.

Note: Administer on an empty stomach for maximum effect.

## **PROTON PUMP INHIBITORS**

These drugs suppress gastric acid secretion by inhibiting the hydrogen/potassium adenosine triphosphatase (ATPase) enzyme system, blocking the final step of acid production.

Frequently prescribed proton pump inhibitors include:

- Esomeprazole (Nexium)
- Lansoprazole (Prevacid)
- Omeprazole (Prilosec)

**Units 5 & 6  
Self-Test**

Match Column B with Column A

**Column A**

1. Narcotic antitussive
2. Expectorant
3. Antihistamine
4. Slows gastric emptying
5. Bronchodilator
6. Don't give with renal disease
7. Mucolytic
8. Creates protective barrier over ulcer
9. Blocks gastric acid
10. May cause confusion in elderly

**Column B**

- a. mucomist
- b. cause tachycardia, anxiety
- c. sucralfate (Carafate)
- d. Robitussin with Codeine
- e. Ranitidine (Zantac)
- f. suppress coughing
- g. Cimetidine (Tagamet)
- h. induce coughing
- i. don't give with emphysema
- j. Dyphylline (Lufyllin)
- k. Quaifenisin (Robitussin)
- l. Terfenadine (Seldane)
- m. Propantheline bromide (Probanthine)
- n. Magaldrate (Riopan)

## Unit 7 Hormonal Medications

### CORTICOSTEROIDS

Hydrocortisone (Cortisol), the principle glucocorticoid, and aldosterone, the principle mineralocorticoid, are both corticosteroids or hormones naturally produced in the adrenal cortex. Glucocorticoids regulate the metabolism of fats, carbohydrates, and protein as well as reducing inflammation. Mineralocorticoids help to regulate fluid and electrolyte balance. The purpose of medication therapy with corticosteroids may be to treat adrenal cortical insufficiency, to decrease inflammation, or to cause an immunosuppressant effect.

Some examples of corticosteroids include:

- Hydrocortisone (Cortef)
- Dexamethasone sodium phosphate (Decadron Phosphate)
- Methylprednisolone sodium succinate (Solu-Medrol)
- Methylprednisolone acetate (Depo-medrol)
- Prednisone (Deltasone)
- Fluocinonide (Lidex)
- Tramcinolone acetamide (Aristocort, Kenalog)
- Fludrocortisone acetate (Florinef)

Note: Corticosteroids often create a feeling of well being even euphoria, but they also mask many of the symptoms of underlying illness and potential infection. Many medications interact adversely with corticosteroids; and therefore, the nurse must be familiar with all the medications that the patient is taking. Adverse reactions may affect virtually every body system. Dosage reduction should be gradual to prevent adrenocortical insufficiency.

### ANTIDIABETIC MEDICATIONS AND GLUCAGON

**Antidiabetic medications** either an outside source for insulin (Type I diabetes) or stimulate the beta cells of the pancreas to produce insulin and the body tissues to be more receptive to insulin (Type II diabetes). Type II diabetes is usually treated with diet, exercise, and if necessary, oral antidiabetic medications. Some examples of antidiabetic medications include:

Oral antidiabetics:

- Acetohexamide (Dymelor)
- Chlorpropamide (Diabinese)
- Tolazamide (Tolinase)
- Tolbutamide (Orinase)
- Glipizide (Glucotrol)
- Glyburide (Diabeta, Micronase)

Insulin is used to treat diabetic hyperglycemia. It is available in beef, pork, or “human” preparations and in short, intermediate, and long acting varieties. Dosage is based on blood glucose levels in order to

provide a normal or close to normal blood glucose level over a 24-hour period. Insulin is typically given subcutaneously, but may be administered by IV to the patient with diabetic keto acidosis.

Glucagon, on the other hand, is a hyperglycemic medicine administered to stimulate glucose production in a hypoglycemic patient. Glucagon is used to treat patients in insulin shock to stimulate glucose production.

Note: You should know the signs/symptoms of hypo and hyperglycemia. Advise patients against consumption of alcohol which causes hypoglycemia. Oral antidiabetic medicines should be given one half-hour before a meal.

## Unit 8 Medications to Keep Fluids and Electrolytes in Balance

### DIURETICS

These drugs facilitate excretion of water and electrolytes by increasing sodium excretion, decreasing sodium reabsorption, or increasing the glomerular filtration rate. Diuretics are used to treat open angle glaucoma, hypertension, edema, and increased intracranial pressure. Some examples of commonly prescribed diuretics include:

- Chlorothiazide (Diuril)
- Chlorthalidone (Hygroton)
- Furosemide (Lasix)
- Spironolactone (Aldactone)
- Triamterene (Diazide, Maxide)
- Acetazolamide (Diamox)
- Mannitol (Osmitol)

Note: Some patients may need electrolyte replacement therapy (potassium). Monitor serum electrolytes closely. On occasion, potassium-sparing diuretics such as Aldactone or Diazide cause hyperkalemia (elevated serum potassium).

## Unit 9 Hematologic Medications

### ANTICOAGULANTS AND HEPARIN ANTAGONISTS

**Anticoagulant** medications are used to prevent blood clot formation in high risk patients, which generally includes those with a history of clot formation, those on prolonged bed rest, and those undergoing certain high risk surgical procedures, such as hip arthroplasty. Anticoagulants do not dissolve existing clots; they prevent the formation of new ones by interfering with the clotting process. The oral anticoagulants act as Vitamin K antagonists to create non-functional clotting factors. Some examples include Heparin sodium given IV or subcutaneously and Warfarin sodium (Coumadin) usually given orally.

Note: Watch closely for signs of bleeding, of the gums, GI tract, genito urinary system (GU); bruising; or epistaxis. When giving subcutaneous Heparin, it is generally recommended not to aspirate the syringe or massage the tissue following the injection. Monitor patients' lab values of Partial Thromboplastin (PTT), Activated Partial Thromboplastin Time (APTT) if on Heparin and Prothrombin Time (PT) if on Coumadin.

**Anticoagulant antagonists** reverse the effects of the anticoagulant. Protamine Sulfate neutralizes Heparin and is given by IV for Heparin overdose. Vitamin K can be given parenterally or orally for an overdose of oral anticoagulant.

**Thrombolytic medications** actually dissolve existing blood clots and are used when the occlusion of the vessel threatens to cause necrosis of the tissue distal to the clot. Although thrombolytic agents have been used to treat pulmonary emboli and deep vein thrombosis, the most accepted use of these highly dangerous medications has been in the treatment of myocardial infarctions to dissolve clots in the coronary arteries that threaten imminent necrosis of the myocardial tissue.

Some examples of thrombolytic agents are:

- Streptokinase (Streptase)
- Urokinase (Abbokinase)

Note: Oral anticoagulants or Heparin cannot be used concurrently. Adverse reactions of a profound nature include major hemorrhage, life-threatening dysrhythmias, and anaphylaxis. Patients with a history of bleeding disorders, recent bleeding episodes, or uncontrolled hypertension are poor risks for therapy. Aminocaproic acid (Amicar) is a possible antidote to reverse the action of thrombolytic medicines.

## **BIBLIOGRAPHY**

Lilley, L. & Aucker, R. (2001). Pharmacology and the nursing process. (3<sup>rd</sup> ed.) St. Louis: Mosby.

McKenny, L. & Salerno, E. (2003). Mosby's pharmacology in nursing. (21<sup>st</sup> ed.). St. Louis: Mosby.

**Units 7, 8 & 9**  
**Self-Test**

Match Column B with Column A.

Column A

1. Dissolves blood clots
2. May need potassium replacement
3. Monitor PTT
4. Vitamin K antagonist
5. Antegoagulant antagonist
6. Potassium sparing diuretic
7. Decrease inflammation
8. Oral antidiabetic
9. Type I diabetics need
10. Stimulate glucose production

Column B

- a. Coumadin
- b. Protamine sulfate
- c. Heparin
- d. Spironolactone (Aldactone)
- e. Depo Medrol
- f. Glucagon
- g. Furosemide (Lasix)
- h. Glipizide (Glucotrol)
- i. Streptokinase (Streptase)
- j. Fluocinonide (Lidex)
- k. Insulin

**Module 8**  
**Answers to Self-Tests**

Unit 1

1. e, h
2. k
3. f, h
4. a, h
5. b
6. c
7. d
8. i
9. g, h

Unit 2

1. visual: blurred vision, spots, halos, flickering lights  
cardiac: bradycardia, tachycardia, dysrhythmias
2. Digoxin (Lanoxin), Digitoxin (Crystodigin)
3. Lidocaine (Xylocaine)
4. Norpace, Procan SR, Pronestyl, Quinidine
5. Inderol (Propranolol)
6. Calan (Verapamil)
7. headache and hypotension
8. antilipemic—medications lowering serum cholesterol
9. Hydralazine (Apresoline), Diltrazem (Cardizem), Nifedipine (Procardia)
10. weight loss, stop smoking, reduce sodium intake

Unit 3

1. c
2. d
3. c
4. a
5. h
6. i
7. b
8. e
9. i
10. k

## Unit 4

1. a
2. a, b, d
3. bethanechol (Urecholine), metaclopramide (Reglan), neostigmine (Prostigmin), and pilocarpine (Pilocar)
4. a, b, c
5. a, c, d
6. a, b
7. a
8. b
9. a

## Units 5 &amp; 6

1. f, i d
2. h, k
3. l
4. m
5. j, b
6. n
7. a
8. c
9. e
10. g

## Units 7, 8 &amp; 9

1. i
2. g
3. c
4. a
5. b
6. d
7. e, j
8. h
9. k
10. f

