Course Learning Outcomes for Unit V

Upon completion of this unit, students should be able to:

1. Examine drugs that are used to treat central nervous system conditions.
2. Evaluate drugs that are used to treat autonomic nervous system conditions.
3. Discuss anesthetic agents, including the four stages.
4. Discuss drugs that are used to treat skin conditions.

Reading Assignment

Chapter 17:
Drugs Used to Treat Central Nervous System Conditions

Chapter 18:
Drugs Used to Treat Autonomic Nervous System Conditions

Chapter 19:
Anesthetic Agents

Chapter 20:
Drugs Used to Treat Skin Conditions

Unit Lesson

Welcome to Unit V. Unit V will focus on the discussion of the drugs and/or drug classes that are used to treat central nervous system conditions, autonomic nervous system conditions, anesthetic agents, and drugs that are used to treat skin conditions.

The Nervous System

The human brain is composed of about 100 billion neurons (nerve cells) that can help to coordinate all of the other body functions to maintain homeostasis and to enable the body to respond to changing conditions (Moini, 2013). The nervous system contains organs that can be divided into two groups. The first group, the central nervous system, consists of the brain and spinal cord. The brain is divided into four major portions that include the cerebrum, diencephalon, brain stem, and cerebellum. The spinal cord is a slender nerve column that passes down from the brain into the vertebral canal, continuing on to the peripheral organs, skeletal muscle, and carrying motor impulses. The second group, the peripheral nervous system, consists of nerves that connect the central nervous system to other body parts. Together, both parts of the nervous system concentrate on three functions: sensory, integrative, and motor.

Disorders that can be observed with the central nervous system are anxiety and insomnia. Anxiety is common and can be self-limiting, so medications may not be necessary, but in certain instances, drug therapy may be required. Insomnia is a sleep disorder that is also common (Moini, 2013). A sedative (which can also be referred to as an anxiolytic) can be used to relieve anxiety and works by reducing the activity of the central nervous system. A hypnotic can be used to describe a substance that induces sleep. The difference between most hypnotics and anxiolytics is the dosage, not the drug, and most are evaluated based on chemical classification and not therapeutic classification. Benzodiazepines can be used as sedatives or hypnotics. Examples include diazepam, alprazolam, or lorazepam). Barbiturates are classified as central nervous system agents, anticonvulsants, and sedative-hypnotic drugs. Examples include phenobarbital.
Epilepsy is a permanent, recurrent seizure disorder that may be caused by brain injury at birth, head injuries, and inborn errors of metabolism, and, in some cases, the cause is unknown. Drugs that are used to treat seizures are categorized based on chemical structure and mechanism of action. The chemical groupings include hydantoin (e.g., fosphenytoin, phenytoin), succinimides (e.g., ethosuximide, methsuximide), barbiturates (phenobarbital mephobarbital), and benzodiazepines (e.g., diazepam, lorazepam). There are other miscellaneous drugs that are used as anticonvulsants, such as carbamazepine, valproic acid or valproate, primidone, gabapentin, and lamotrigine. All can serve to depress the abnormal neural discharges in the central nervous system. To see the full list of antiseizure drugs, view Table 17.2: Most Commonly Prescribed Antiseizure Drugs located on page 289 in your textbook.

Click here to view a video on epilepsy.

Your textbook describes our next topic, Parkinson's disease, as, “a nervous system disorder characterized by movement abnormalities, such as tremors of the extremities and head, difficulty with coordination of fine muscle movement. The other salient feature is hypokinesia, or an inability or slowness in initiating movements” (Moini, 2013, p. 293). The cause is unknown, but it has been proposed that this defect is in the basal ganglia portion of the midbrain called the substantia nigra, which is important in the initiation and control of muscular movement. The drug classes that are used to manage Parkinson's disease include anticholinergic drugs (e.g., benztropine, biperiden, trihexyphenidyl) that inhibit muscarinic receptors in the basal ganglia to reduce the imbalance between the extrapyramidal and pyramidal pathways by blocking the effect of acetylcholine. Dopaminergic drugs, such as levodopa, are precursors of dopamine, but unlike dopamine, levodopa readily crosses the blood-brain barrier. Other dopaminergic agents include amantadine and bromocriptine.

Schizophrenia is one of the most common psychotic disorders affecting approximately 1.6% of the population (about two million people in the United States). The cause of schizophrenia is unknown but manifestations include positive symptoms (e.g., hallucinations, delusions), and negative symptoms (e.g., anhedonia, social withdrawal, apathy). Antipsychotic medications are one of the major drug classes that are used to treat people with schizophrenia. Antipsychotic medications can be categorized as typical (e.g., chlorpromazine, fluphenazine, haloperidol) or atypical antipsychotics (e.g., aripiprazole, clozapine, olanzapine). Antipsychotic medications have a complex mechanism of action but are thought to work to block dopaminergic and serotoninergic receptors. Typical antipsychotic medications are primarily focused on dopaminergic activity, while atypical antipsychotic medications work on both dopaminergic and serotoninergic receptors. Lithium carbonate can also be used to control the symptoms of manic and depressive phases of psychotic disorders.

Major depression is another common psychiatric disorder in the United States. Most antidepressants are used in the management of endogenous depression. The hallmark symptoms of depression include feelings of doom, lack of self-worth, inability to sense pleasure, loss of energy, inability to concentrate, changes in sleep habits, or thoughts of suicide (Moini, 2013). Antidepressants are classified into several groups based on chemical structures and action in the brain. The common antidepressant classes include monoamine oxidase inhibitors (e.g., phenelzine, tranylcypromine), tricyclic antidepressants (e.g., amitriptyline, amoxapine), selective serotonin reuptake inhibitors (e.g., citalopram, escitalopram, fluoxetine), and selective-norepinephrine reuptake inhibitors (e.g., duloxetine, venlafaxine).

**Autonomic Nervous System**

The autonomic nervous system (ANS) is a division of the peripheral nervous system (PNS). PNS itself can be divided into the motor and sensory neurons. The motor neurons are divided into the sympathetic nervous system, which accelerates heart rate, constricts blood vessels, and raises blood pressure. The parasympathetic nervous system slows heart rate, increases intestinal and glandular activity, and relaxes muscles. This division is an anatomical division rather than a strict neurotransmitter division with each division using two effenter neurons to carry neural signals to the effector tissues with the specific receptor (Moini, 2013). Drugs that affect the autonomic nervous system can be categorized based on which of the receptors are blocked or stimulated. The sympathomimetics (adrenergic agonist) produce symptoms of the fight-or-flight response and stimulate the sympathetic nervous system. The parasympathomimetics (cholinergic agonists) produce symptoms of the rest-and-relaxation response and stimulate the parasympathetic nervous system. The adrenergic blockers produce actions opposite to sympathomimetics and inhibit the sympathetic nervous system, and the anticholinergics (cholinergic blockers) produce actions opposite to parasympathomimetics and inhibit the parasympathetic nervous system.
The desired characteristics of an ideal anesthetic agent would be to produce rapid and pleasant induction and withdrawal of anesthesia, skeletal muscle relaxation, analgesia (pain relief while still conscious), high potency, a wide therapeutic index, nonflammability, and chemical inertness with regards to anesthetic delivery devices. The stages of anesthesia include:

- Stage 1: analgesia
- Stage 2: excitement
- Stage 3: surgical anesthesia
- Stage 4: medullary paralysis

Preanesthetics are given 45 to 70 minutes prior to surgical procedures. Preoperative medications that can be used as adjuncts to surgery include benzodiazepines, opioid analgesic, anticholinergics, or antiemetics (Moini, 2013). General anesthesia affects the entire body and can make the person unconscious by depressing the central nervous system. The advantages of general anesthesia are the rapid excretion of the anesthetic agent and prompt reversal of its effects when desired. In addition, general anesthesia can be used with all age groups in any type of surgical procedure. Inhalation anesthetics are given to induce or maintain general anesthesia either as gases or vapors (inhalation anesthetics) or injections (IV anesthetics). There are a few types of local anesthetics that are used to provide regional or topical anesthesia to aid with pain relief and provide localized nerve block. Topical anesthetics involve the placement of a nerve-conduction blocking agent onto a tissue layer (skin or mucous membrane). Local infiltration anesthesia works by blocking nerves and is produced by the injection of a local anesthetic solution directly into an area that is painful or about to be operated on. Field block anesthesia is a form of regional anesthesia, which affects a single nerve, a deep plexus, or a network of nerves. Spinal anesthesia is an anesthetic agent that is injected into the subarachnoid space beneath the arachnoid membrane or between the arachnoid and pia mater and filled with cerebrospinal fluid. Spinal anesthesia may cause hypotension, headaches, or respiratory depression. Epidural anesthesia involves the injection of the local anesthetic into the epidural (lumbar or caudal space via a catheter that allows repeated infusions. This is popular for labor and delivery. High concentrations of local anesthetics can get into the blood circulation to increase the risk of systematic toxicity.

The Skin

Lastly, the skin is part of the integumentary system, which is the largest of all organs of the human body. The skin consists of two distinct layers, the epidermis (outer layer), and the dermis (the inner layer), which is thicker than the epidermis. Skin integrity may be damaged by trauma, abnormal cellular function, infection and inflammation, and systematic disease (Moini, 2013). Disorder of the skin may be caused by infection, and others can be caused by inflammatory conditions resulting from allergies. The most common inflammatory disorder of the skin is eczema, which is a response of the skin caused by the endogenous and exogenous agents and can be synonymous with dermatitis (Moini, 2013). The mainstay for treatment for the presentation of acute or chronic inflammatory disorders is topical corticosteroids. Examples of inflammatory skin disorders are psoriasis and can vulgaris. Keratoses are characterized by a thickening of the keratin layer of the skin. Keratolytic agents such as salicylic acid, resorcinol, and sulfur can promote shedding of the horny layer of the epidermis and softening of scales. Bacterial skin infections can be caused by local invasion of pathogens. Dermatophytes are fungi that infect the skin, hair, and nails. Candidiasis is another fungal infection caused by Candida albicans. Topical and systematic therapies can be used to treat dermatophyte infections and Candida albicans. Topical antibiotic drugs include azelaic acid or bacitracin, and topical antifungal drugs include ciclopirox and econazole. Scabies are a group of dermatologic conditions that are caused by mites that burrow into the skin, causing an intense itching. Pediculosis is a lice infestation that can affect the hairy areas of the body. Scabicides are pharmacologic drugs that kill mites, and pediculicides kill lice. Drugs that are used to treat lice can include lindane, permethrin, or pyrethrins.

Reference

Suggested Reading

Click here to access the PDF of the Chapter 17 Presentation.
Click here to access the PDF of the Chapter 18 Presentation.
Click here to access the PDF of the Chapter 19 Presentation.
Click here to access the PDF of the Chapter 20 Presentation.

Go to www.myhealthprofessionskit.com (companion website for course textbook) to review one to two Internet sites of interest.


- Appendix A: Medications, Classifications, and Body Systems Affected, p. 353
- Appendix B: Compilation of Drug Profiles, p. 360

National Institute of Mental Health: Discussion of latest treatments on schizophrenia, depression, and other psychiatric disorders
http://www.nimh.nih.gov

Concepts of neurotransmitters, the autonomic system, and more at http://faculty.washington.edu/chudler/ehceduc.html


American Academy of Dermatology’s Website: http://www.aad.org

Learning Activities (Non-Graded)

For additional practice before you begin your graded work, complete the following Apply your Knowledge: Critical Thinking Questions in your textbook:

- 17.1: Apply your knowledge Questions:1-8
- 17.2: Apply your knowledge Questions:1-8
- 17.3: Apply your knowledge Questions:1-8
- 17.4: Apply your knowledge Questions:1-6
- 17.5: Apply your knowledge Questions:1-5
- 18.1: Apply your knowledge Questions:1-5
- 18.2: Apply your knowledge Questions:1-8
- 18.3: Apply your knowledge Questions:1-5
- 19.1: Apply your knowledge Questions:1-5
- 19.2: Apply your knowledge Questions:1-8
- 19.3: Apply your knowledge Questions:1-5
- 19.4: Apply your knowledge Questions:1-5
- 20.1: Apply your knowledge Questions:1-5
- 20.2: Apply your knowledge Questions:1-5
- 20.3: Apply your knowledge Questions:1-6

Non-graded Learning Activities are provided to aid students in their course of study. You do not have to submit them. If you have questions, contact your instructor for further guidance and information.