Course Learning Outcomes for Unit VI

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

1. Examine how the cardiovascular system works and the various parts that make it up.
2. Analyze appropriate drugs that are used to treat cardiovascular conditions.
3. Identify antihypertensive agents of hypertension.
4. Evaluate drugs that are used to treat vascular conditions.
5. Discuss anticoagulants.
6. Discuss drugs that are used to treat fluid and electrolyte imbalances.

Reading Assignment

Chapter 21: Drugs Used to Treat Cardiovascular Conditions

Chapter 22: Drugs Used to Treat Vascular Conditions

Chapter 23: Anticoagulants

Chapter 24: Drugs Used to Treat Fluid and Electrolyte Imbalances

Unit Lesson

Welcome to Unit VI. Unit VI will focus on the discussion of the drugs and/or drug classes that are used to treat cardiovascular conditions and vascular conditions, anticoagulants, and drugs to treat fluid and electrolyte imbalances.

The Circulatory System

The circulatory system is referred to as the cardiovascular system that is made up of the heart and blood vessels. The cardiovascular system is divided into two branches: pulmonary circulation and systematic circulation. The pulmonary circulation allows for blood to pick up oxygen and liberates the waste product, which is carbon dioxide. In the systematic circulation, blood carries oxygen and nutrients to all of the active cells and transports waste products to the kidneys, liver, and skin for excretion.

The heart is a muscular pump that is located within the mediastinum of the thorax and is composed of three layers: the endocardium (thin membrane lining the inside of the cardiac muscle), myocardium (cardiac muscle), and epicardium (thin membrane lining of the inside of the myocardium). The heart is also composed of four compartments that maintain the body’s blood circulation with the two smaller upper chambers called the left atrium and the right atrium. The two lower chambers are called the left and right ventricles. The electrical conduction system contains the wiring to initiate and maintain the rhythmic contraction of the heart; the system consists of the sinoatrial node (SA), atrioventricular node (AV), bundle of His, and Purkinje fibers (Moini, 2013). An electrocardiogram is used to trace the heart’s electrical activity and measures electrical activity across the myocardium.

One of the major causes of ischemia, or “when the delivery of oxygen to the myocardium is not adequate to meet the heart’s oxygen consumption needs” (Moini, 2013, p.360), is coronary heart disease. Angina pectoris is an episodic, reversible oxygen insufficiency that may result from the obstruction or narrowing of coronary
arteries, arterial spasm, pulmonary hypertension, and cardiac hypertrophy. The types of angina include classical (stable) angina, variant vasospastic angina, or unstable angina. Antianginal drugs are primarily used for the treatment of angina pectoris. These consist of organic nitrates, or the oldest and most frequently prescribed drugs for the different types of angina. Examples include isosorbide dinitrate and isosorbide mononitrate, erythryl tetranitrate, and pentaerythritol tetranitrate. Beta adrenergic blockers (e.g., propranolol, atenolol) and calcium channel blockers (e.g., verapamil, bepridil) can also be used. An acute myocardial infarction (AMI) occurs when part of the myocardium experiences a severe and prolonged restriction of oxygenated coronary blood. It is reported that nearly 40% of all patients experiencing AMI die before reaching acute care health centers (Moini, 2013). The therapeutic agents that are available for myocardial infarction include nitroglycerin, which is given to decrease workload and increase blood supply to the heart muscle. Aspirin and other thrombolytic drugs are most effective if given within the first few minutes and hours after the onset of MI. Morphine sulfate (2mg to 4mg IV) repeated as needed is a critical adjunct to nitroglycerin.

Dysrhythmias are deviates from the normal orderly sequence of impulses and a disturbance in the rhythm. An area of muscle in one of the atria becomes more excited than that SA node and fires more rapid impulses. Antidysrhythmic drug therapy is considered to be the mainstay of management for most important dysrhythmias. They are based on cellular electrophysiologic effects and have been classified into four groups. The classifications of antidysrhythmic drugs include Class Ia (drugs with intermediate onset and offset), Class Ib (drugs with short effects), Class Ic (drugs with prolonged effects), Class II (beta adrenergic blockers), Class III (drugs that interfere with potassium outflow), and Class IV (Calcium channel blockers) (Moini, 2013).

Vascular Conditions and Drug Treatments

It is approximated that about 60 million people in the United States have hypertension (systolic blood pressure more than 140 mmHg and diastolic above 90 mmHg) or those taking antihypertensive medications (Moini, 2013). Hyperlipidemia is defined as an elevation of lipoprotein levels in the plasma, which is also a strong risk factor for cardiovascular disease (CVD). The vascular system is divided into three components: arterial pressure, capillary pressure, and venous pressure. Blood pressure is generally arterial pressure, which is created by the pumping action of the heart and varies from one vessel to another within the systematic circuit. The three main factors that affect blood pressure are cardiac output, peripheral resistance, and blood volume, and most of the drugs that are used to treat hypertension target one of these three factors. Antihypertensives are used to reduce blood pressure to within normal limits. Drug therapies used in the treatment of hypertension include diuretics (reduce circulating blood volume), beta-adrenergic blockers (slow heartbeat and dilate vessels), vasodilators (dilate vessels), calcium channel blockers (slow heartbeat, reduce conduction irritability and dilate vessels), and angiotensin-converting enzyme (ACE) inhibitors that produce vasodilatation and increase renal blood flow. The administration of any of these medications is designed to meet patients’ needs and responses. Congestive heart failure (CHF) occurs when the heart pumps less blood than it receives, which can result in blood accumulating in the heart chambers and the stretching of the heart walls. It can also be accompanied by abnormal increases in blood volume and the interstitial fluids. The therapeutic goal for the treatment of CHF is to increase cardiac output. There are three drugs that have been shown to be clinically effective in reducing symptoms and prolonging life: inotropics (increase the cardiac muscle’s strength of contractions), diuretics, and vasodilators, including ACE inhibitors.

Hyperlipidemia is characterized by an increase in plasma cholesterol or triglycerides containing lipoprotein particles, which are key elements to the development of atherogenesis. An individual with a high serum cholesterol and increased low density lipoprotein (LDL) is at risk for atherosclerotic coronary disease. Antihyperlipidemic medications are used if diet modification and exercise programs fail to lower LDL to normal levels. When medications are started, diet therapy must be continued. The major drugs for the reduction of LDL cholesterol are bile acid sequestrants (e.g., colestipol, cholestyramine resin) and nicotinic acid (e.g., niacin). The fibric acid derivatives are less effective in reducing LDL cholesterol. The most effective drugs for lowering plasma LDL levels are HMG-CoA Reductase Inhibitors (Statin Drugs), such as atorvastatin or fluvasatin.

Anticoagulants or blood thinners are medications that are used to prolong bleeding time, and they help to prevent harmful clots from forming in the blood vessels. Anticoagulants prevent clots from becoming large and causing more serious problems. They can be used in the treatment of cardiovascular and lung conditions, and they can be used to prevent transient ischemic attacks and to reduce the risk of recurrent MI. The two main groups of anticoagulants are drugs that are administered orally and drugs that are administered parenterally. Warfarin is an example of an oral anticoagulant, and heparin is an example of an anticoagulant that is only given parenterally. Drugs that dissolve clots that are already formed are thrombolytic agents or
tissue plasminogen activators that include streptokinase (Streptase, Kabikinase) and urokinase (Abbokinase), which are not considered to be anticoagulants.

**The Kidneys**

The function of the kidneys is to maintain a stable internal environment for optional cell and tissue metabolism, which is accomplished through life sustaining tasks that balance solute and water transport, excreting metabolic waste products, conserving nutrients, and regulating acids and bases. Each kidney contains about one million functional units of nephrons that are located in the renal cortex (Moini, 2013). The purpose of urine production is to maintain homeostasis by regulating the volume and composition of blood. This process involved the excretion of solutes, metabolic waste products (urea, creatinine, and uric acid). These waste products dissolve in the bloodstream and can be eliminated only while dissolved in the bloodstream or urine. Nephrons are specifically recognized for controlling the composition of body fluids and removing waste from the blood. Urine volume is regulated by controlling the reabsorption of water. The balance should exist between water and electrolytes, which involves mechanism to ensure that lost water and electrolytes are replaced and that excesses are excreted out. Water balance exists when water intake equals water output with homeostasis requiring the control of water intake and output. An electrolyte balance can exist when the quantities of electrolytes (molecules that release ions in water) gained and lost are equal. The electrolytes that are considered to be important for cellular function release sodium, potassium, calcium, magnesium, chloride, sulfate, phosphate, bicarbonate, and hydrogen ions. The body can lose electrolytes through perspiration, feces, or kidney function and urine production. The kidneys act to alter renal electrolyte losses to maintain the proper composition of body fluids.

**Reference**


**Suggested Reading**

Go to [www.myhealthprofessionskit.com](http://www.myhealthprofessionskit.com) (companion website for course textbook) to review one-two Internet sites of interest.

Click [here](http://example.com) to view the PDF of the Chapter 21 Presentation.

Click [here](http://example.com) to view the PDF of the Chapter 22 Presentation.

Click [here](http://example.com) to view the PDF of the Chapter 23 Presentation.

Click [here](http://example.com) to view the PDF of the Chapter 24 Presentation.


- Chapter 9: Cardiac Arrhythmias, pp.159
- Chapter 10: Congestive Heart Failure, pp.177
- 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
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:

- 21.1: Apply your knowledge Questions:1-5
- 21.2: Apply your knowledge Questions:1-8
- 21.3: Apply your knowledge Questions:1, 3-5
- 21.4: Apply your knowledge Questions:1-8
- 22.1: Apply your knowledge Questions:1-8
- 22.2: Apply your knowledge Questions:1-10
- 22.3: Apply your knowledge Questions:1-5
- 22.4: Apply your knowledge Questions:1-6
- 23.1: Apply your knowledge Questions:1-6
- 23.2: Apply your knowledge Questions:1-8
- 23.3: Apply your knowledge Questions:1-5
- 24.1: Apply your knowledge Questions:1-8
- 24.2: Apply your knowledge Questions:1-5
- 24.3: Apply your knowledge Questions:1-5

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.