U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
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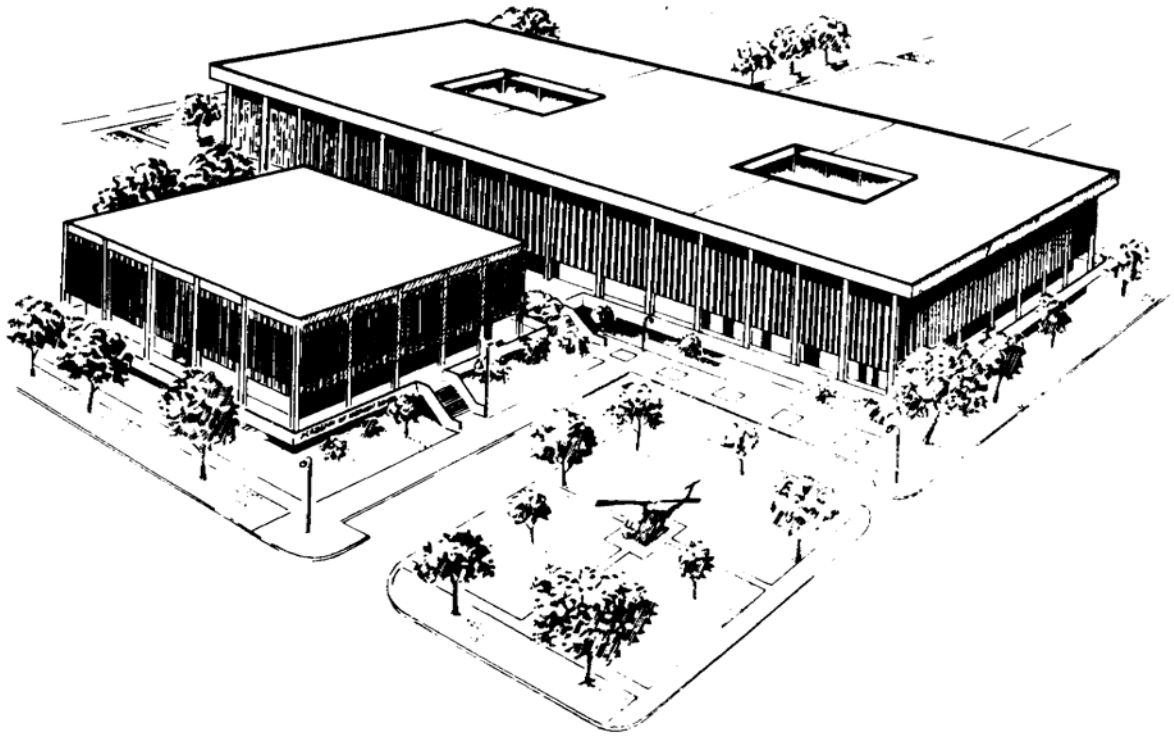

NURSING CARE RELATED TO THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS

SUBCOURSE MD0917 EDITION 100

DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

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CORRESPONDENCE COURSE OF
THE ACADEMY OF HEALTH SCIENCES, UNITED STATES ARMY

SUBCOURSE MED917

NURSING CARE RELATED TO THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS

INTRODUCTION

A patient is not a passive object on which we perform nursing care procedures. A patient should never be thought of, or discussed, as merely a condition or injury. It is not acceptable to think of, or refer to, your patient as "the gallbladder" or "the fractured hip" or "the bleeding ulcer." A patient is much more than the condition that brought him to the hospital. A patient is a human being, possessing physical and emotional needs and wants.

The relationship between the patient and the nursing staff is extremely dynamic and personal. The patient places his trust in the nursing staff and they, in return, must utilize all their knowledge and skills to ensure the patient's well-being and assist in his return to good health and independence. This is accomplished by developing a therapeutic relationship between the patient, his family, and the health care professionals.

The nursing paraprofessional relates very closely with the patient and his family by virtue of his participation in providing nursing care and his presence at the bedside. It is often the nursing paraprofessional who makes the initial observation that something is not as it should be. Nursing paraprofessionals who are responsible, educated, and observant are assets to the therapeutic environment necessary for patient recovery. To help foster this therapeutic environment, the nursing paraprofessional must do the following:

Assess the patient's ability to express himself.

Assess the patient's mechanisms for coping.

Assess the patient's level of understanding about his condition and the teaching provided by the health care professionals.

Assist the patient to establish a trusting relationship with the health care providers.

Utilize the nursing process to provide the best possible care.

Continue to pursue his own education in order to sustain and enhance professional knowledge and skills.

The purpose of this subcourse is to enhance your knowledge of medical surgical nursing

care related to the cardiovascular and respiratory systems and the role of the nursing paraprofessional in providing that care.

Subcourse Components:

This subcourse consists of 2 lessons and an examination. The lessons are:

Lesson 1, Nursing Care Related to the Cardiovascular System.

Lesson 2, Nursing Care Related to the Respiratory System.

Credit Awarded:

Upon successful completion of this subcourse, you will be awarded 12 credit hours.

Lesson Materials Furnished:

Lesson materials provided include this booklet, an examination answer sheet, and an envelope. Answer sheets are not provided for individual lessons in this subcourse because you are to grade your own lessons. Exercises and solutions for all lessons are contained in this booklet. You must furnish a #2 pencil.

Study Suggestions:

Here are some suggestions that may be helpful to you in completing this subcourse:

--Read and study each lesson carefully.

--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson, marking your answers in this booklet.

--After completing each set of lesson exercises, compare your answers with those on the solution sheet that follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

--As you successfully complete each lesson, go on to the next.

When you have completed all of the lessons, complete the examination, marking your answers in this booklet. Then, transfer your responses to the examination answer sheet.

Student Comment Sheet:

Be sure to provide us with your suggestions and criticisms by filling out the Student Comment Sheet (found at the back of this booklet) and returning it to us with your examination answer sheet. Please review this comment sheet before studying this subcourse. In this way, you will help us to improve the quality of this subcourse.

LESSON ASSIGNMENT

LESSON 1 Nursing Care Related to the Cardiovascular System.

TEXT ASSIGNMENT Paragraphs 1-1 through 1-44.

LESSON OBJECTIVES After completing this lesson, you should be able to:

1-1. Name the two fluid transportation systems of the circulatory system.
1-2. Identify the valves, chambers, and blood vessels of the heart.
1-3. Describe the flow of blood through the heart.
1-4. State the function of the coronary arteries.
1-5. Define pulse.
1-6. Define blood pressure.
1-7. State two purposes of cardiac fluoroscopy.
1-8. Define cardiac catheterization.
1-9. Identify the five major waves of an ECG.
1-10. State the purposes of an ECG.
1-11. Identify the locations for the placement of limb and chest electrodes when performing a standard 12-lead ECG.
1-12. Define pulse deficit.
1-13. Identify the three characteristics that should be noted when taking a patient's pulse.
1-14. List four factors that may affect a patient's pulse.
1-15. Define systolic blood pressure.
1-16. Define diastolic blood pressure.
1-17. State three factors that affect blood pressure.
1-18. Define pulse pressure.
1-19. Define coronary artery disease.
1-20. List six modifiable risk factors.
1-21. Define coronary heart disease.
1-22. Define arteriosclerosis.
1-23. Define arteriosclerosis.
1-24. State the cause of angina pectoris.
1-25. Define AMI.
1-26. State the symptoms of myocardial infarction.
1-27. Define heart failure.
1-28. Explain the difference between left sided heart failure and right sided heart failure.
1-29. Explain the difference between primary and secondary hypertension.

1-30. List four topics included in-patient education for hypertension.
1-31. Define infective endocarditic.
1-32. List three categories of needs that must be assessed during the preoperative period for a CV surgery patient.
1-33. State four complications of cardiovascular surgery.
1-34. State two signs of thrombophlebitis.
1-35. Define cardiac tamponade.
1-36. Describe at least three aspects of post-op nursing for the cardiovascular surgery patient.
1-37. Define cardiac arrest.
1-38. List six causes of sudden cardiac death.
1-39. List three responsibilities of the nursing paraprofessional in relation to cardiac arrest.
1-40. List at least five items found in a crash cart.

SUGGESTION

After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you achieve the lesson objectives.

LESSON 1

NURSING CARE RELATED TO THE CARDIOVASCULAR SYSTEM

Section I. ANATOMY AND PHYSIOLOGY

1-1. INTRODUCTION

The circulatory system has two major fluid transportation systems, the cardiovascular (CV) 00system and the lymphatic system.

a. **Cardiovascular System**. This system, which contains the heart and blood vessels, is a closed system, transporting blood to all parts of the body. Blood flowing through the circuit formed by the heart and blood vessels (see Figure 1-1) brings oxygen, food, and other chemical elements to tissue cells and removes carbon dioxide and other waste products resulting from cell activity.

b. **Lymphatic System**. This system, which provides drainage for tissue fluid, is an auxiliary part of the circulatory system, returning an important amount of tissue fluid to the blood stream through its own system of lymphatic vessels.

1-2. THE HEART

The heart, designed to be a highly efficient pump, is a four-chambered muscular organ, lying within the chest, with about 2/3 of its mass to the left of the midline. It lies in the pericardial space in the thoracic cavity between the two lungs. In size and shape, it resembles a man's closed fist. Its lower point, the apex, lies just above the left diaphragm. Refer to Figure 1-2 as you continue to read.

a. **Heart Layers**. The pericardium is a double walled sac enclosing the heart. The outer fibrous surface gives support, and the inner lining prevents friction as the heart moves within its protecting jacket. The lining surfaces of the pericardial sac produce a small amount of pericardial fluid needed for lubrication to facilitate the normal movements of the heart.

b. **Heart Wall**. The walls of the heart is composed of three distinct layers an outer epicardium- which corresponds to the visceral pericardium it protects the heart by reducing friction, a middle layer the myocardium consist mostly of cardiac muscle tissue that pumps blood out of the heart chambers, an inner layer endocardium consist of epithelium and connective tissue that contains many elastic and collagenous fibers.

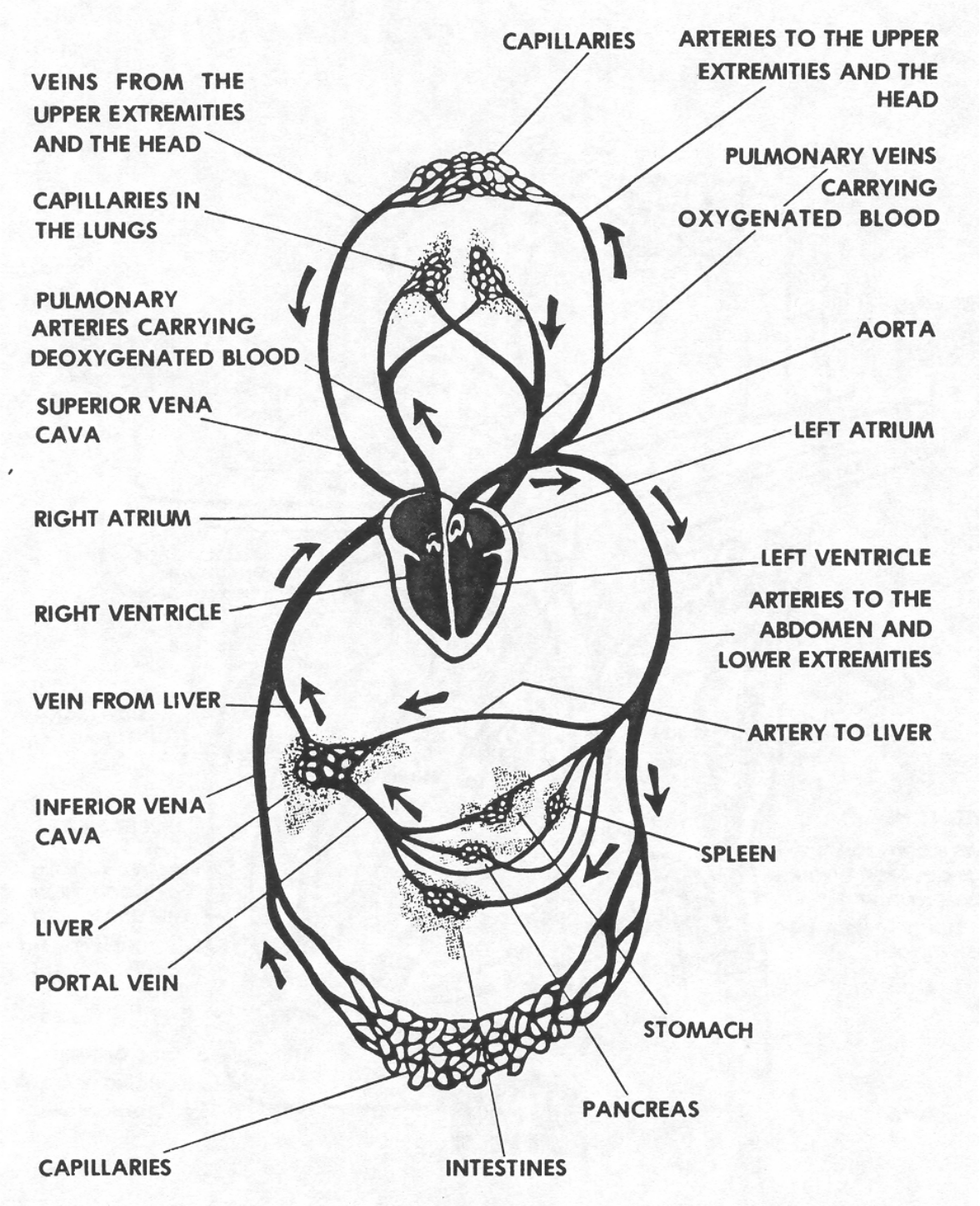


Figure 1-1. The circulatory system.

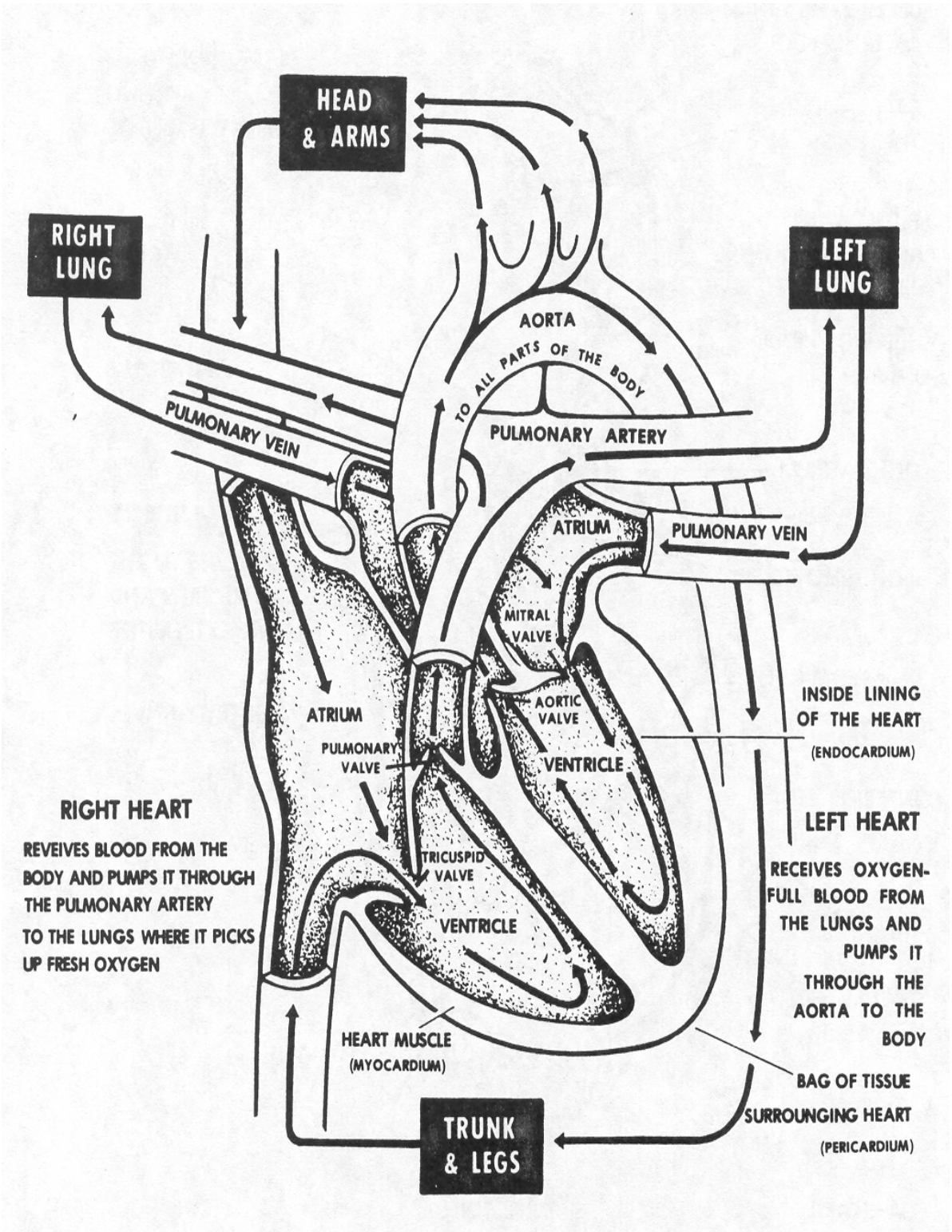


Figure 1-2. The heart.

c. **Heart Chambers**. There are four chambers in the heart. These chambers are essentially the same size. The upper chambers, called the atria, are seemingly smaller than the lower chambers, the ventricles. The apparent difference in total size is due to the thickness of the myocardial layer. The right atrium communicates with the right ventricle; the left atrium communicates with the left ventricle. The septum (partition), dividing the interior of the heart into right and left sides, prevents direct communication of blood flow from right to left chambers or left to right chambers. This is important, because the right side of the heart receives un-oxygenated blood returning from the systemic (body) circulation. The left side of the heart receives oxygenated blood returning from the pulmonary (lung) circulation. The special structure of the heart keeps the blood flowing in its proper direction to and from the heart chambers.

d. **Heart Valves**. The four chambers of the heart are lined with endocardium. At each opening from the chambers this lining folds on itself and extends into the opening to form valves. These valves allow the blood to pass from a chamber but prevent its return. The atrioventricular valves, between the upper and lower chambers, are within the heart itself. The semilunar valves are within arteries arising from the right and left ventricles.

(1) Atrioventricular valves. The tricuspid valve is located between the right atrium and right ventricle. It has three flaps or cusps. The bicuspid valve or mitral valve is located between the left atrium and left ventricle. It has two flaps or cusps.

(2) Semilunar valves. The pulmonary semilunar (half-moon shaped) valve is located at the opening into the pulmonary artery that arises from the right ventricle. The aortic semilunar valve is located at the opening into the aorta that arises from the left ventricle.

1-3. FLOW OF BLOOD THROUGH THE HEART

It is helpful to follow the flow of blood through the heart in order to understand the relationship of the heart structures. Remember, the heart is the pump and is also the connection between the systemic circulation and pulmonary circulation. All the blood returning from the systemic circulation must flow through the pulmonary circulation for exchange of carbon dioxide for oxygen. Blood from the upper part of the body enters the heart through the superior vena cava and blood from the lower part of the body enters through the inferior vena cava.

a. Blood from the superior vena cava and inferior vena cava enters the heart at the right atrium. The right atrium contracts, and blood is forced through the open tricuspid valve into the relaxed right ventricle.

b. As the right ventricle contracts, the tricuspid valve is closed, preventing back flow into the atrium. The pulmonary semilunar valve opens as a result of the force and movement of the blood, and the right ventricle pumps the blood into the pulmonary artery.

c. The blood is carried through the lung tissues, exchanging its carbon dioxide for oxygen in the alveoli. This oxygenated blood is collected from the main pulmonary veins and delivered back to the left side of the heart to the left atrium.

d. As the left atrium contracts, the oxygenated blood flows through the open bicuspid (mitral) valve into the left ventricle.

e. As the left ventricle contracts, the bicuspid valve is closed. The aortic semilunar valve opens as a result of the force and movement of the blood, and the left ventricle pumps oxygenated blood through the aortic semilunar valve into the aorta, the main artery of the body. Oxygenated blood now starts its flow to all of the body cells and tissues. The systemic circulation starts from the left ventricle, the pulmonary circulation from the right ventricle.

1-4. BLOOD AND NERVE SUPPLY OF THE HEART

a. **Coronary Arteries**. The heart gets its blood supply from the right and left coronary arteries (Figure 1-3). These arteries branch off from the aorta just above the Aortic Valve, then subdivide into many smaller branches within the heart muscle. If any part of the heart muscle is deprived of its blood supply through interruption of blood flow through the coronary arteries and their branches, the muscle tissue deprived of blood cannot function and will die. This is called myocardial infarction (MI). Blood from the heart tissue is returned by coronary veins to the right atrium via the coronary sinus.

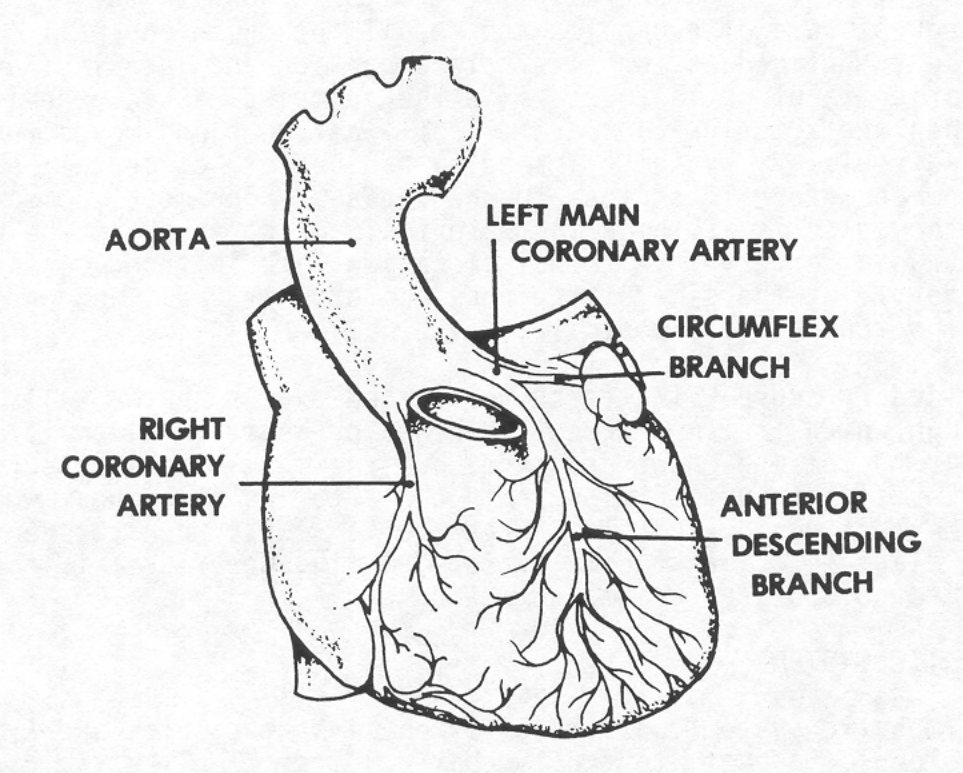


Figure 1-3. The coronary arteries.

b. **Nerve Supply**. The nerve supply to the heart is from two sets of nerves originating in the medulla of the brain. The nerves are part of the involuntary (autonomic) nervous system. One set, the branches from the vagus nerve, keeps the heart beating at a slow, regular rate. The other set, the cardiac accelerator nerves, speeds up the heart. The heart muscle has a special ability; it contracts automatically, but the nerve supply is needed to provide an effective contraction for blood circulation. Within the heart muscle itself, there are special groups of nerve fibers that conduct impulses for contraction. These groups make up the conduction system of the heart. When the conduction system does not operate properly, the heart muscle contractions are uncoordinated and ineffective. The impulses within the heart muscle are tiny electric currents, which can be picked up and recorded by the electrocardiogram, the ECG.

1-5. BLOOD VESSELS

The blood vessels are the closed system of tubes through which the blood flows. The arteries and arterioles are distributors. The capillaries are the vessels through which all exchange of fluid, oxygen, and carbon dioxide takes place between the blood and tissue cells. The capillaries are the smallest of these vessels but are of greatest importance functionally in the circulatory system. The venules and veins are collectors, carrying blood back to the heart.

a. **The Arteries and Arterioles**. The system of arteries and arterioles is like a tree, with the large trunk, the aorta, giving off branches that repeatedly divide and subdivide. Arterioles are very small arteries, about the diameter of a hair. By way of comparison, the aorta is more than one inch in diameter. An artery wall has a layer of elastic, muscular tissue that allows it to dilate and constrict. When an artery is cut, this wall does not collapse, and bright red blood escapes from the artery in spurts.

b. **Capillaries**. Microscopic in size, capillaries are so numerous that there is at least one or more near every living cell. A single layer of endothelial cells forms the walls of a capillary. Capillaries are the essential link between arterial and venous circulation. The vital exchange of substances between the capillary blood and the tissue cells takes place through the capillary wall. Blood starts its route back to the heart as it leaves the capillaries.

c. **Veins**. Veins have thin walls and valves. Formed from the inner vein lining, these valves prevent blood from flowing back toward the capillaries. Venules, the smallest veins, unite into veins of larger and larger size as the blood is collected for return to the heart. The superior vena cava, collecting blood from all regions above the diaphragm and the inferior vena cava, collecting blood from all regions below the diaphragm, return the venous blood to the right atrium of the heart. Superficial veins lie close to the surface of the body and can be seen through the skin.

1-6. PULSE AND BLOOD PRESSURE

a. **Pulse**. This is a characteristic associated with the heartbeat and the subsequent wave of expansion and recoil set up in the wall of an artery. Pulse is defined as the alternate expansion and recoil of an artery. With each heartbeat, blood is forced into the arteries causing them to dilate (expand). Then the arteries contract (recoil) as the blood moves further along in the circulatory system. The pulse can be felt at certain points in the body where an artery lies close to the surface. The most common location for feeling the pulse is at the wrist, proximal to the thumb on the palm side of the hand (radial artery). Alternate locations are in front of the ear (temporal artery), at the side of the neck (carotid artery), and on the top (dorsum) of the foot (dorsalis pedis).

b. **Blood Pressure**. The force that blood exerts on the walls of vessels through which it flows is called blood pressure. All parts of the blood vascular system are under pressure, but the term blood pressure usually refers to arterial pressure. Pressure in the arteries is highest when the ventricles contract during systole. Pressure is lowest when the ventricles relax during diastole. The brachial artery, in the upper arm, is the artery usually used for blood pressure measurement.

1-7. LYMPHATIC SYSTEM

The lymphatic system consists of lymph, lymph vessels, and lymph nodes. The spleen belongs, in part, to the lymphatic system. Unlike the cardiovascular system, the lymphatic system has no pump to move the fluid that collects, but muscle contractions and breathing movements aid in the movement of lymph through its channels and its return to the blood stream.

a. **Lymph and Tissue Fluid**. Lymph, fluid found in the lymph vessels, is clear and watery and is similar to tissue fluid, which is the colorless fluid that fills the spaces between tissues, between the cells of organs, and between cells and connective tissues. Tissue fluid serves as the "middleman" for the exchange between blood and body cells. Formed from plasma, it seeps out of capillary walls. The lymphatic system collects tissue fluid, and as lymph, the collected fluid is started on its way for return to the circulating blood.

b. **Lymph Vessels**. Starting as small blind ducts within the tissues, the lymphatic vessels enlarge to form lymphatic capillaries. These capillaries unite to form larger lymphatic vessels, which resemble veins in structure and arrangement. Valves in lymph vessels prevent backflow. Superficial lymph vessels collect lymph from the skin and subcutaneous tissue; deep vessels collect lymph from all other parts of the body. The two largest collecting vessels are the thoracic duct and the right lymphatic duct. The thoracic duct receives lymph from all parts of the body except the upper right side. The lymph from the thoracic duct drains into the left subclavian vein, at the root of the neck on the left side. The right lymphatic duct drains into a corresponding vein on the right side.

c. **Lymph Nodes**. Occurring in groups up to a dozen or more, lymph nodes lie along the course of lymph vessels. Although variable in size, they are usually small oval bodies that are composed of lymphoid tissue. Lymph nodes act as filters for removal of infective organisms from the lymph stream. Important groups of these nodes are located in the axilla, the cervical region, the sub maxillary region, the inguinal (groin) region, and the mesenteric (abdominal) region.

d. **Infection and the Lymphatic System**. Lymph vessels and lymph nodes often become inflamed as the result of infection. An infection in the hand may cause inflammation of the lymph vessels as high as the axilla (armpit). A sore throat may cause inflammation and swelling of lymph nodes in the neck (submandibular nodes below the jaw and cervical nodes posteriorly).

e. **Spleen**. The largest collection of lymphoid tissue in the body, the spleen is located high in the abdominal cavity on the left side, below the diaphragm and behind the stomach. It is somewhat long and ovoid (egg- shaped). Although it can be removed (splenectomy) without noticeable harmful effects, the spleen has useful functions, such as serving as a reservoir for blood and red blood cells.

Section II. DIAGNOSTIC PROCEDURES

1-8. INTRODUCTION

a. Cardiovascular diagnostic tests and examinations are conducted by order of the physician to help him determine the nature of the specific disease condition. Many of these tests or examinations may be repeated at intervals to determine the patient's progress or response to prescribed treatment. While some are performed on the nursing unit, many others are conducted only in special laboratories and hospital clinics.

b. The nursing paraprofessional's role in assisting with diagnostic tests and collection of specimens will vary, depending upon the test, the specimen, the condition of the patient, and the local situation and policy. Although they may seldom perform any part of the test themselves, they should be acquainted with those commonly performed in order to give intelligent patient care and appropriate assistance to the doctor, nurse, or technician. In general, they should know:

(1) How and why the procedure is done and what, if any, reaction is expected from it.

(2) What explanation and physical care the patient should have before, during, and after the procedure. The informed, prepared patient is more apt to cooperate and to tolerate any inconvenience or discomfort incidental to the test.

(3) What equipment, clean or sterile, must be provided when assisting with the procedure and how to care for used equipment following the procedure.

(4) The role of the assistant in relation to that of the doctor, nurse, or technician performing the test.

1-9. GENERAL PREPARATORY MEASURES FOR PROCEDURES PERFORMED OFF THE NURSING UNIT

Procedures vary from one hospital to another concerning nursing unit preparation of patients who are to be sent or escorted to clinics, laboratories, radiology, or operating rooms. These various departments set their own standing operating procedure in accordance with local directives and issue instructions to the nursing units. These instructions and the doctor's orders for the particular patient must be carried out carefully to ensure the best results for the patient. A few general rules to remember are:

a. **Prepare the Patient Mentally**. Tell the patient briefly what to expect and explain his role in the preparation. Mental preparation of the patient gives him emotional security and gains his confidence and cooperation.

CAUTION: Always verify with the nurse or doctor what information you may give to the patient.

b. **Prepare the Patient Physically**. Have the patient clean, properly dressed, and protected from exposure or drafts. Make sure that any specific preparation ordered has been accomplished, such as medication, rest for a required period, or restriction on food or liquids.

c. **Have the Right Patient in the Right Place at the Right Time**. If he is an ambulatory patient, give him specific directions on how to reach the clinic or laboratory. Transport an otherwise ambulatory patient who has received a sedative or other pretreatment medication in a wheelchair or on a stretcher. The responsibility of nursing unit personnel accompanying the patient ends only after the patient is placed in the care of the personnel who are to perform the procedure.

d. **Be Sure That Forms Are Signed**. Ensure that SF 522 (Clinical Record--Authorization for Administration of Anesthesia and for Performance of Operations and Other Procedures), if required, is signed by the patient or the patient's sponsor and witnessed by a medical officer, nurse, or other suitable individual.

e. **Send the Patient's Clinical Record and X-rays to the Off-Unit Examination Areas.** Enclose the record in a sealed manila envelope to safeguard the contents. Check to see that the records are returned with the patient.

1-10. GENERAL NURSING CARE DURING DIAGNOSTIC PROCEDURES PERFORMED ON THE NURSING UNIT

In addition to the general rules mentioned in the previous paragraph, you should:

a. Assist the physician as required. This may involve obtaining equipment, opening sterile trays, preparing a sterile field, pouring solutions, preparing the patient's skin, positioning the patient, draping the patient, and assisting the physician in the performance of the procedure.

b. Reassure the patient and make him as comfortable as possible.

NOTE: For some patients and some procedures, two assistants will be needed one to support and observe the patient and one to assist the doctor.

c. If a specimen is taken, attach to the specimen container a prepared label identifying the patient by name and register number, ward, date, and test. Forward the specimen to the laboratory immediately with the proper laboratory request slip.

1-11. GENERAL NURSING CARE FOLLOWING DIAGNOSTIC PROCEDURES

a. Return the patient to his bed by the means ordered.

b. Check the orders of the physician who performed the procedure. Observe and report any unusual reactions of the patient. If there are no orders pertaining to taking vital signs, accomplish this nursing measure according to standard nursing unit procedures.

c. Use appropriate measure to relieve discomfort or pain.

d. If the patient has been sedated or anesthetized, ensure bed rest until he has completely reacted. Tell him to stay in bed and to signal for any needs. Use side rails according to standard procedures. Ensure the call light is with in reach of the patient.

e. If the procedure involves the patient's diet, notify food service to serve, modify, or cancel his meal as appropriate.

f. Explain to the patient that he will be notified when he may resume his normal regime. When this time arrives, inform him promptly.

g. Record the following information in the nursing notes.

(1) Date and time.

(2) Type of procedure.

(3) Where and by whom performed.

(4) Disposition of specimen, if taken.

(5) Significant observations on patient's reaction such as pain, discomfort, and apprehension.

(6) Patient's vital signs before and after the procedure (when these are required).

1-12. FLUOROSCOPY

Fluoroscopy shows the heart in action and is used more often than other x-ray methods in cardiologic examinations. Fluoroscopy is used to look for abnormal configuration, tumors, and calcifications in the heart, aorta, and pulmonary vessels, to find congestion of the lungs, and to detect pleural or pericardial effusions. During examination of the heart under fluoroscopy, barium is given by mouth so the outline of the esophagus can be seen. An enlarged left atrium pushes the esophagus aside as it becomes larger. There is no preparation of the patient for this examination.

1-13. INTRAVENOUS ANGIOCARDIOGRAPHY

This is a procedure in which an opaque medium is injected into a vein followed by a rapid series of x-ray pictures taken of the course of the medium through the heart, to the lungs, back to the heart, and out through the aorta. The dosage of contrast media is calculated according to the kilograms of body weight. The solution is injected through a large bore (12 gauge) needle held in position in the vein, usually by a "cut down." Speed of injection is imperative, since the solution must pass through the heart in a large bolus to make possible a good examination. The solution is injected after the patient has been instructed to inhale deeply. The inspiration is held for the entire series of x-rays.

a. This diagnostic method is recognized for precision in detecting congenital cardiac defects. Individual chambers of the heart are visualized, pathways for the blood stream are demonstrated, and chamber enlargement can be seen.

b. The opaque medium may cause a flushing sensation as it flows through the body. If necessary, the studies may be conducted under mild anesthesia. After one complete circulation, the opaque media is so diluted that it is no longer visible by x-ray.

c. No special preparation of the patient is necessary unless anesthesia is to be given. In that event, food may be withheld prior to the studies. A record of the patient's weight should be sent to the x-ray department with him.

1-14. AORTOGRAM

The aorta and its branches are studied by the injection of a contrast medium through a plastic catheter or with a needle directly into the aorta. Terms used in connection with the aortogram are retrograde aortogram (retrograde meaning against the direction of blood flow) and translumbar aortogram (meaning the injection is made below the twelfth rib and to the left of the spine). No preparation of the patient is necessary.

1-15. CARDIAC CATHETERIZATION

This is a procedure in which a radiopaque catheter is manipulated through the heart under fluoroscopic observation. The exterior end of the catheter is connected by a three-way stopcock to a saline filled regulated drip system that also contains a pressure gauge (strain gauge) and a camera. During the procedure the blood pressures within the heart are automatically transmitted to the strain gauge that, in turn, transmits the pressure to the camera recording the findings on photographic film. Samples of blood are also withdrawn from the heart chambers and great vessels. The samples are analyzed for oxygen content.

a. The pressures within the heart indicate any existing strain placed on individual heart chambers. The oxygen content indicates whether the blood is circulating directly through the heart or whether the blood is being shunted because of an anatomical defect.

b. During the entire procedure an electrocardiograph and an electro-tachometer is recording readings on photographic paper. The electro-cardio-tachometer is connected by leads that operate, as do those of the electrocardiograph and instantaneously records the heart rate. It also contains a small light that flashes on with each heartbeat, thus enabling the doctor to observe in the dark the condition of the patient.

c. There are several routes used for the catheter approach to the heart. Not long ago only the right side of the heart was studied by catheterization. The cardiac catheter was inserted by means of a "cut-down" into the antecubital vein of either arm, then manipulated through the innominate vein, superior vena cava, right atrium, tricuspid valve, right ventricle, semilunar valve, and pulmonary artery. The cardiac catheter may also be placed in the right or left femoral vein, then manipulated through the inferior vena cava it may then follow the same path as the catheter entered through the antecubital vein.

d. Several studies also include the left side of the heart. The approach is made directly to the left atrium by means of an 18-gauge, 6-inch needle with a stylet through the patient's back directly into the heart. After the tip of the needle is placed in the left atrium, the stylet is removed and the catheter is manipulated into the left atrium, left ventricle, and the ascending aorta.

e. Studies now also include the examination of both sides of the heart simultaneously through the transthoracic introduction of two needles, one in each atrium.

f. The patient is taken to the fluoroscopy or cardiology department for the study. The entire procedure may last from 1 to 3 hours. The procedure is a painless one. The patient is prepared as follows:

(1) Solid foods are withheld. Liquids are permitted up to 3 hours prior to the procedure.

(2) Diphenhydramine and Valium may be given 30 minutes prior to the procedure.

(3) A systemic antibiotic may be administered prophylacticly to prevent infection.

(4) After the procedure the patient is returned to his nursing unit, remaining flat in bed for 24 hours or more. The vital signs and insertion site are checked every 10 minutes during the first hour, then every 30 minutes for 3 hours. The patient may be nauseated following the procedure.

1-16. ELECTROCARDIOGRAM

a. The electrocardiogram (ECG or EKG) is a graphic recording of the electrical impulses produced in association with the heartbeat. Impulse formation and conduction produce weak electrical currents that spread throughout the entire body. By connecting certain points on the body to a recording instrument, these currents can be recorded as a graphic representation of the heartbeat, measured against time. Time is expressed on the special ECG graph paper by vertical and horizontal lines.

b. Normally, each heartbeat is represented as five major waves: P, Q, R, S, and T. The Q,R, and S waves all represent the same portion of the heart and are referred to as a unit: the QRS complex.

(1) The P wave represents atrial depolarization. The QRS complex represents ventricular depolarization.

(2) The QRS complex represents the impulse traveling through the ventricles, at which time there is no heart contraction.

(3) The T wave is produced by electrical recovery of the ventricles, at which time there is no heart contraction it represents ventricular repolarization.

c. The standard ECG machine utilizes 12 "leads." These leads represent paths of electrical activity and are designated as leads I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, and V6. It is neither practical nor necessary to go into an explanation of leads in this text. To do so would require extensive explanation of electrophysiological principles. It will suffice to say that each lead senses and records the electrical impulses from different positions related to the heart's surface. Since each lead takes a different view of heart activity, it generates its own characteristic tracing. Wave abnormalities that appear in the different leads indicate damage or defects in particular portions of the heart muscle.

d. The ECG provides quite a bit of valuable information for the small amount of effort involved in obtaining an ECG recording. It is a procedure that is completely noninvasive and without risk to the patient. It is easily performed by anyone with the proper training. The ECG provides information about the heart rate, rhythm, the condition of the myocardium, the presence of ischemia or necrosis, conduction abnormalities, the presence of certain drugs, and the effects of disturbed electrolytes.

e. Because it does provide so much valuable information, it is important that the procedure be performed correctly. Correct procedure will vary depending upon the type of equipment used in your facility. Be sure to read the local standard operating procedures (SOP) and the manufacturer's instructions before attempting to use the equipment. Another important factor in correct performance is proper placement of the electrodes. Electrodes should be secured over a fleshy area, not over a bone, as bone interferes with the electrical impulse readings. In order to obtain accurate readings the patient may need to be shaved using a prep razor if the area where the electrodes are to be placed. Location of the electrodes is standard for all designs of ECG equipment.

(1) Leg electrodes are best placed on the medial or lateral aspect of the calf to avoid contact with bone.

(2) Arm electrodes are best placed on the inner aspect of the arm or forearm, several inches above or below the antecubital space.

(3) Chest electrodes are placed as follows. Remember to place the electrodes over the intercostal spaces, not over the ribs.

(a) V1: 4th intercostal space at the right sternal border.

(b) V2: 4th intercostal space at the left sternal border.

(c) V3: Halfway between V2 and V4.

(d) V4: 5th intercostal space at the midclavicular line.

(e) V5: 5th intercostal space at the anterior axillary line.

(f) V6: 5th intercostal space at the midaxillary line.

1-17. STRESS TEST

Stress testing or exercise testing is done to assess cardiac function. Stress testing is accomplished by having the patient climb stairs, pedal a stationary bicycle, or walk a treadmill. The exercise is gradually increased (climb or walk faster, pedal harder) while the patient is monitored. Electrocardiogram electrodes attached to the patient record tracings before, during, and after exercise. Additionally, blood pressure, physical appearance, and chest pain levels are monitored closely.

1-18. BLOOD STUDIES

a. **Electrolytes**. Serum electrolyte studies are frequently performed on cardiac patients. Of particular significance are calcium, sodium, and potassium.

(1) Calcium has a role in cell permeability, formation of bones and teeth, blood cell coagulation, nerve impulse conduction, and normal muscle contraction. Elevated calcium levels (hypocalcaemia) may cause HTN and cardiac arrest. Decreased calcium levels (hypocalcaemia) may cause tetany, convulsions, hypotension, and cardiac arrhythmias.

(2) Sodium functions in maintaining the concentration of extra cellular fluid, acid-base balance, water balance, and nerve conduction. Elevated sodium levels (hypernatremia) may cause weight gain, pitting edema, HTN, and tachycardia. Decreased sodium levels (hyponatremia) may cause hypotension and tachycardia. If depletion is severe, vaso-motor collapse may occur.

(3) Potassium is the dominant cellular electrolyte. It facilitates contraction of skeletal and smooth muscle to include myocardial contraction. Potassium is also concerned in acid-base balance, nerve impulse conduction, and cell membrane function. Both decreased potassium levels (hypokalemia) and increased potassium levels (hyperkalemia) diminish the excitability and conduction rate of the cardiac muscle. This may lead to bradycardia, tachycardia, cardiac arrhythmias, and cardiac arrest.

b. **Cultures.** Blood cultures are performed to detect the presence of bacteria in the blood. This test is useful in the diagnosis of bacterial endocarditis.

c. **Enzymes**. Enzyme studies are done to detect damage to the myocardium. The enzymes creatine phosphokinase (CPK) and lactic dehydrogenase (LDH) are found in increased levels after myocardial tissue damage. However, these enzymes are also

present in other tissue, and blood levels may be elevated as a result of damage to skeletal muscles, the liver, the kidneys, and other organs. This results in a false positive.

d. **Isoenzymes.** Isoenzymes are forms of enzymes that can be differentiated from one another.

(1) One isoenzyme of the enzyme CPK is present in significant amounts only in myocardial tissue. This isoenzyme is identified as CPK-MB.

(2) Lactic dehydrogenase has five isoenzymes, and cardiac muscle is associated with large amounts of the isoenzymes LDH1.

(3) The determination of the isoenzymes (CPK-MB and LDH is more specific in evaluation myocardial damage than simple enzyme determinations.

1-19. PULSE

a. Each time the heart beats, the left ventricle contracts and sends blood through the arteries. The pulse is the rhythmic expansion of the arteries that results from each heartbeat. The pulse may be felt most strongly over the following areas:

(1) Radial artery in the wrist at the base of the thumb.

(2) Temporal artery in front of the ear.

(3) Carotid artery in the neck.

(4) Femoral artery in the groin.

(5) Over the apex (tip) of the heart (apical pulse).

b. Two other locations for palpation of the pulse are the popliteal artery at the back of the knee and the pedal pulses of the foot. Pedal pulses are located on both the lateral and medial aspects of the ankle and on the top of the foot. These pulses are often difficult to locate.

c. The physician may request that both a radial and apical pulse be taken simultaneously to see if there is a difference in rates. A significant difference is indicative of vascular disease. This difference between the apical and radial pulse is known as the pulse deficit.

d. When the pulse is being counted, the rate, rhythm, and volume (force) should be noted.

(1) Rate may be noted as normal, fast (tachycardia), or slow (bradycardia). An average pulse rate for a resting adult is 70-80 bpm (beats per minute). Rates faster than 100 bpm are considered to be tachycardia. Rates slower than 60 bpm are considered to be bradycardia.

NOTE: A well-trained athlete may have a resting pulse of less than 50 bpm.

(2) Rhythm is the regularity of the pulse beats. Rhythm is described as irregular when you can feel the pulsations occur at different rates. A normal rhythm has the same time interval between the beats.

(3) Volume is the force or strength of the pulse. Terms used to describe the volume (force) of the pulse are weak, thready, or feeble for a pulse that lacks strength, and strong, full, or bounding for a pulse that feels forceful. Additionally, the force may be regular or irregular.

e. There are many factors that affect the pulse rate. Some are listed below.

(1) Sex. Women have a slightly faster pulse rate than men.

(2) Age. The pulse rate gradually decreases from birth to adulthood then increases with advancing old age.

(3) Body temperature. The pulse rate generally increases 7-10 beats for each degree of temperature elevation.

(4) Digestion. The increased metabolic rate during digestion will increase the pulse rate slightly.

(5) Pain. Pain increases pulse rate.

(6) Emotion. Fear, anger, anxiety, and excitement increase the pulse rate.

(7) Exercise. The heart must beat faster during exercise to meet the increased demand for oxygen.

(8) Blood pressure. In general, heart rate and blood pressure have an inverse relationship. When the blood pressure is low, there is an increase in pulse rate as the heart attempts to increase the output of blood from the heart (cardiac output).

1-20. BLOOD PRESSURE

a. Blood pressure is defined as the pressure exerted by the blood on the walls of the blood vessels. When speaking of blood pressure, it is the arterial blood pressure that we are concerned with. When taking a patient's blood pressure with a sphygmomanometer and stethoscope, it is the arterial blood pressure that is being measured.

b. Blood pressure is registered by two numbers that represent the pressures exerted during contraction and relaxation of the heart.

(1) Systolic pressure is the maximum pressure occurring during systole, or contraction, of the ventricles. It is the higher of the two numbers. Normal systolic pressure for the average resting adult is between 100-150 mmHg.

(2) Diastolic pressure is the pressure occurring during diastole, the period of relaxation and filling of the ventricles. This is the lowest pressure. Normal diastolic pressure for the average resting adult is between 60-90 mmHg.

c. Blood pressure is best measured over a large artery. The most commonly used is the brachial artery. The cuff is wrapped around the upper arm and auscultation is done over the brachial artery in the antecubital space.

(1) With extremely obese patients, the application of the cuff around the forearm and auscultation over the radial artery may give a truer measurement of blood pressure.

(2) Blood pressure may also be taken in the leg by wrapping the cuff around the thigh and auscultating the popliteal artery behind the knee.

(3) An accurate blood pressure reading depends upon the width of the cuff in relation to the diameter of the limb used. If the cuff is too large for the limb, as in a child, the reading obtained could be significantly lower than the true pressure. If the cuff is too small for the limb, as in an obese person, the reading obtained may be higher than the true pressure.

d. Blood pressure depends upon the force of the heartbeat, the volume of blood in the circulatory system, and the resistance within the blood vessels. Other factors that affect blood pressure are:

(1) Pain. Moderate to severe pain will increase blood pressure.

(2) Emotions. Fear, anger, anxiety, or excitement will increase blood pressure.

(3) Disease. Disease conditions may cause abnormal increase or decrease of blood pressure.

e. In patients with hypertension or other cardiovascular disease, it is best to measure blood pressure in both the right and left arms. There should be no more than 5 mmHg difference between the two readings. A greater difference is indicative of vascular disease.

f. The physician may order blood pressure checks to be done with the patient lying down, sitting, and standing. The corresponding rise or fall in pressure with the change of position may give the physician valuable information about the nature of the cardiovascular disease.

g. Pulse pressure is the difference between the systolic and diastolic pressures. Normal range for pulse pressure should be 30-50 mmHg, with 40 mmHg the average.

(1) A decreased pulse pressure (less than 30 mmHg) is related to factors that cause an increase in the diastolic blood pressure, a decrease in systolic blood pressure, or a combination of both. Causes of decreased pulse pressure included peripheral vasoconstriction, aortic valve stenosis, mitral valve insufficiency, or decreased stroke volume due to heart failure or hypovolemia.

(2) An increased pulse pressure (greater than 50 mmHg) is related to factors that cause a decrease in the diastolic blood pressure, an increase in systolic blood pressure, or both. Causes of increased pulse pressure include hypertension, circulatory overload, arrhythmias, increased stroke volume caused by anxiety or exercise, or decreased distensibility of the arteries as seen in arteriosclerosis and aging.

Section III. CARDIOVASCULAR DISORDERS

1-21. CORONARY ARTERY DISEASE

Coronary artery disease (CAD) is the condition in which the coronary arteries cannot deliver adequate blood supply to the heart muscle to meet the tissue demand. This condition is characterized by obstruction or narrowing of the vessel lumen. Coronary artery disease has been linked with certain "risk factors." In general, the more risk factors associated with an individual, the greater the chance for development of CAD. Some risk factors cannot be changed, while other risk factors can be modified or eliminated. Patient education is an important aspect of the nursing care of patients with CAD because the educated patient can take steps to improve his condition.

1-22. RISK FACTORS.

a. Risk factors that cannot be changed (non-modified) are age, sex, race, genetic make-up, and family history.

b. The major risk factors, however, fall into the category of modifiable risk factors. Hypertension, elevated serum cholesterol levels, and cigarette smoking have been identified as the three major risk factors. These factors can be modified and controlled by taking prescribed blood pressure medication, modifying eating habits, and giving up cigarettes.

c. Additional modifiable risk factors include weight, activity level, and stress levels. These factors can be controlled by maintaining an appropriate weight, making life style adjustments to reduce stress, and increasing physical activity.

1-23. ARTERIOSCLEROSIS

a. Arteriosclerosis is the primary cause of CAD. Arteriosclerosis is defined as hardening or thickening of the arteries. Arteriosclerotic disease is characterized by thickening and loss of elasticity of the arterial walls.

b. Atherosclerosis is the most common form of arteriosclerosis. Deposits of yellowish plaques (called atheromas) are formed within the medium and large sized arteries. These atheromas are made up of cholesterol, lipoid material, and lipophages (cells that ingest or absorb fat).

1-24. CORONARY HEART DISEASE

a. Coronary heart disease (CHD) is a collective name for a number of ischemic diseases of the myocardium. Coronary heart disease is the eventual clinical manifestation of the effects of CAD.

b. The major diseases of CHD are: angina pectoris, cardiac dysrhythmias, myocardial infarction, congestive heart failure, and sudden cardiac death.

1-25. ANGINA PECTORIS

a. Angina pectoris is a clinical syndrome of ischemic heart disease, manifested by paroxysmal pain in the chest and adjacent areas. This disorder is considered to be an early warning of CV deterioration. The symptoms occur as a result of myocardial oxygen demand that exceeds the ability of the coronary arteries to deliver oxygen. (The coronary arteries supply the myocardium with the oxygenated blood it needs to work effectively.) The main cause for this inability to meet oxygen demand is the presence of aterosclerosis that causes advanced occlusion or stenosis of one or more of the three major branches of the coronary artery tree. The coronary arteries are illustrated in Figure 1-3.

b. When the heart is stressed, it must rely on increased coronary blood flow to meet the increased oxygen demand of the cardiac tissue. Coronary blood flow is determined by the amount of pressure in the aorta and the amount of resistance in the coronary arteries. If atherosclerosis is present in the coronary vascular system, coronary blood flow is decreased because of the increased resistance in the coronary arteries.

c. The pain of angina pectoris occurs when the heart is stressed or worked to a point where the oxygen demand is greater than the amount of oxygen that can be delivered. This usually occurs with some type of exertion, such as mowing the lawn, climbing stairs, or doing heavy housework. In the affected patient, the onset of pain will occur with exertion, and relief will normally occur with rest. Rest will decrease the workload on the heart, thereby decreasing the heart's oxygen demand and relieving the pain.

d. Unstable angina pectoris is a term used to describe the exacerbation of the symptoms of angina pectoris. This syndrome is characterized by increased severity of symptoms, increased ease in provoking attacks of angina, and less predictability in controlling angina attacks. Symptoms may be severe enough to mimic an acute myocardial infarction. Crescendo angina and acute coronary insufficiency are also terms used to describe unstable angina.

e. In either case, medical management is the same. The patient is educated about the nature of the disease so that it may be controlled with diet, medication, exercise, and risk factor modification. When the condition advances to the stage where it can no longer be controlled in this manner, surgical intervention may be indicated. Two surgical possibilities include the coronary artery bypass graft (CABG) and transluminal coronary angioplasty (balloon compression).

1-26. ACUTE MYOCARDIAL INFARCTION

a. Acute myocardial infarction (AMI) results from an imbalance between oxygen demand and oxygen supply to the myocardium. In 90 percent of the cases of AMI, this imbalance is preceded by atherosclerosis and decreased blood flow in the coronary arteries. The inadequate blood flow results in decreased oxygen delivery to the heart muscle, which causes ischemia, injury, and death of a portion of the myocardium (infarction).

b. Myocardial infarctions are described as being anterior, inferior, or posterior, depending upon the location of the infarcted area of the heart muscle. Infarcts can be further classified as being transmural or non-transmural. A transmural infarct (Non Q-Wave MI) is one that involves damage to the full thickness of the myocardium. A nontransmural MI involves only a partial thickness of the muscle.

c. In the majority of patients with AMI, chest pain is the major presenting symptom. The pain is usually substernal and may radiate to the neck, shoulders, arms, or epigastric area. The pain is described as heaviness, constriction, burning, or similar to indigestion. It is important to remember, however, that there may be little or no pain present at all. AMI can be very subtle, and often difficult to distinguish from angina. In addition to chest pain, symptoms of MI include shortness of breath, diaphoresis, weakness, fatigue, anxiety, nausea, vomiting, abnormal blood pressure, and abnormal heart rate.

d. Pain, anxiety, and arrhythmias occur in the early stages of MI. Ventricular fibrillation is the greatest threat to life in the first hours after MI. Medical management includes ECG monitoring, bedrest to reduce the workload of the heart, and intravenous therapy. Medications include morphine to reduce pain and relieve anxiety, vaso-dialators, beta blocker, calcium channel blockers and lidocaine as antiarrhythmic therapy.

e. Nursing management of a patient with AMI is intensive in nature, requiring close monitoring of the patient's status and progress, along with concurrent patient education. The nursing staff works closely with the physician, physical therapist, and dietician to develop an individualized rehabilitation plan for the patient. This post myocardial infarction rehabilitation plan, often referred to as the "MI protocol," takes the patient from complete bed rest during the first days of his MI to discharge from the hospital several weeks later. The protocol is a plan of progressive, monitored "steps" of increased activity and exercise, accompanied by intensive patient education. The rehabilitation plan is implemented upon physician's orders once the patient's condition is stable. Rehabilitation is advanced by the physician, who bases his decisions upon daily review of the patient's status and the information recorded by the nursing staff. Important information regarding patient tolerance and acceptance of the rehabilitation process is obtained by the nursing staff and recorded in the patient's chart.

f. Nursing care is directed toward three major considerations: observation and prevention of further myocardial damage and complications, promotion of an environment that allows for maximum comfort and rest, and patient education to fully prepare the patient for discharge.

(1) Observation and prevention include the following nursing considerations:

(a) Frequent monitoring of the patient's vital signs and ECG.

(b) Observation for signs of impending heart failure by close monitoring of intake and output, daily weight, breathe sounds, and serum enzymes.

(c) Careful assessment and documentation of each episode of chest pain to include severity, duration, medication given, and relief obtained.

(2) Promotion of a restful and comfortable environment includes the following nursing considerations:

(a) Provide emotional support to reduce anxiety and stress.

(b) Orient the patient to the coronary care unit (CCU) routine and environment. Take time to explain procedures.

(c) Schedule patient care activities carefully to avoid interrupting the patient's sleep.

(3) Patient education is necessary to prepare the patient for resuming life outside the hospital setting. The following nursing considerations should be included:

(a) Promote compliance with prescribed medications, diet, and other treatment measures by thoroughly explaining the need for each and the possible consequences of noncompliance.

(b) Review all activity limitations and restrictions.

(c) Counsel the patient on the action that should be taken when he is confronted with chest pain or other symptoms.

1-27. HEART FAILURE

a. Heart failure is the clinical state in which there is inadequate cardiac output, resulting in poor perfusion of all organ systems.

b. In left sided heart failure, the pumping action of the left ventricle is compromised, but the right ventricle continues to function normally. There is an imbalance between the out-put of each ventricle. The right heart continues to pump blood into the lungs to be oxygenated. The failing left heart, however, is unable to return that same volume of blood to the systemic circulation. The result is an accumulation of blood in the pulmonary blood vessels. Increased pressure in the pulmonary vessels causes fluid to leak into the interstitial lung tissue, compromising gas exchange. This condition is called pulmonary edema.

c. Right sided heart failure usually follows left sided failure. The increased pressure in the pulmonary vessels causes "back pressure" to the right side of the heart. This interferes with venous return, and consequently, the organs of the body become congested. This condition, known as congestive heart failure (CHF), is manifested by neck vein distention and body edema.

d. Right sided failure may occur without left sided failure. This condition, called corpulmonale, may be caused by pulmonary hypertension secondary to lung disease or by the presence of pulmonary emboli.

e. Medical management of heart failure is twofold. The first concern of treatment is to stabilize the failure, relieving the edema and congestion. The second concern is to discover and treat the underlying cause of the failure.

f. Nursing care of the patient with heart failure involves two major areas: nursing intervention during the acute phase of illness and patient education to prepare the patient for discharge.

(1) During the acute phase, nursing considerations include the following:

(a) Monitoring fluid retention by weighing the patient daily.

(b) Monitoring intake and output.

(c) Frequent assessment of vital signs.

(d) Frequent monitoring of electrolytes.

(e) Promoting mental and physical rest to reduce the workload of the heart.

(f) Administration of prescribed medications to improve the heart's effectiveness as a pump.

(g) Administration of prescribed dietary restrictions (sodium and fluids).

(2) Patient education should include the following nursing considerations:

(a) Instruction on effective coping mechanisms that will reduce stress in daily living.

(b) Compliance in taking prescribed medications.

(c) Compliance in following the prescribed dietary and fluid restrictions.

(d) The importance of regular check-ups.

1-28. HYPERTENSION

a. Hypertension (HTN) is defined as persistent levels of blood pressure with the systolic pressure greater than 150 mmHg and the diastolic pressure greater than 90 mmHg. Hypertension is a major cause of heart failure, kidney failure, and stroke.

b. Hypertension is classified as primary and secondary.

(1) Primary (or essential) HTN has no identifiable cause. Increased peripheral resistance is the basic cause for the elevated blood pressure, but the cause of the increased resistance is not understood. Drug therapy is aimed at decreasing the peripheral resistance, thereby lowering the blood pressure.

(2) Secondary HTN is the result of a specific cause or disease process. Kidney disease, adrenal tumors, thyrotoxicosis, and preeclampsia are just a few examples. Therapy is aimed at both treating the elevated pressures and treating the primary cause.

c. Hypertension is called the "silent killer" because it is often symptom free. When symptoms do occur, they are often mistakenly associated with other causes. Symptoms include headache, fatigue, nervousness, irritability, dyspnea, and edema.

d. Continued HTN is damaging to the body. Medical management is aimed at lowering the blood pressure to alleviate the symptoms and to slow the progression of damage to the body.

e. Nursing management involves intensive patient education to help the patient understand the nature of his disease and his role in keeping it under control. The nursing staff should reinforce the importance of the following:

(1) Taking medications as prescribed.

(2) Decreasing the use of tobacco and stimulants, such as caffeine.

(3) Eliminating table salt and avoiding foods high in sodium, such as pickles, potato chips, cold cuts, and processed foods.

(4) Controlling serum cholesterol levels by modifying the diet to avoid saturated fats.

(5) Maintaining a weight appropriate to height and body type.

(6) Altering one's lifestyle to minimize stress.

(7) Following a regular exercise program.

1-29. VALVE DISORDERS

a. The function of the heart's valves is to maintain the forward flow of blood from the atria to the ventricles and from the ventricles into the great vessels.

b. Valvular damage interferes with this forward flow by stenosis (narrowing) of the valve or by impaired closure of the valve that allows a backward leakage of blood. This is called valvular insufficiency or regurgitation.

c. If the heart muscle itself remains strong, the circulatory mechanisms can adjust and compensate for a bad valve. These modifications are called compensatory changes.

d. Valve deficiencies cause two basic types of stress on the heart. If the stress produced is greater than the heart's ability to compensate, eventual deterioration will occur. The two types of heart stress associated with valve deficiencies are:

(1) Pressure overload (associated with valvular stenosis).

(2) Volume overload (associated with valvular insufficiency and regurgitation).

1-30. INFECTIVE ENDOCARDITIS

a. Infective (bacterial) endocarditis is a microbial infection of endocardial tissue. The endocardium is the layer of tissue that lines the heart's cavities and covers the flaps of its valves.

b. When an area of endocardium becomes inflamed, a fibrin clot called a vegetation may form. This clot will later form into a mass of scar tissue. The scarred endothelium becomes stiff, thick, and deformed. Vegetations on the valves may eventually cause chronic valvular disease.

c. Endocarditis is categorized as either acute or subacute. This is determined by the virulence of the causative organism.

(1) In acute infective endocarditis, the infecting organism is highly virulent, causing rapid and severe complications.

(2) In subacute infective endocarditis, the infecting organism is of low virulence. Severe complications do not occur until late in the illness, if at all.

d. Because standard medical treatment for infective endocarditis involves intravenous antimicrobial agents for a period of 4-6 weeks, the patient will require nursing intervention to prevent depression and alleviate the boredom that will result from the lengthy hospitalization. As the patient begins to feel better, he will feel confined and restricted by intravenous (IV).

e. Nursing management of patients with endocarditis includes the following:

(1) Obtain a history of allergies prior to the administration of antibiotics.

(2) Ensure patency of IV and prevent the complications of long- term IV therapy.

(3) Observe for signs and symptoms of complications such as CHF, renal failure, or emboli.

(4) Educate the patient about his condition and the need for continued treatment and prophylactic antibiotics.

(5) Teach the patient to recognize the symptoms of endocarditis and to seek medical assistance should symptoms recur.

Section IV. NURSING CARE OF THE CARDIOVASCULAR SURGICAL PATIENT

1-31. INTRODUCTION

Through the use of modern techniques, it is possible for surgeons not only to repair damage or deformity of the large blood vessels but also to stop the heart, open it, and perform necessary surgery there. For purposes of discussion of nursing care, cardiovascular surgical patients may be considered under three general conditions: (1) those whose hearts have been opened or entered, as in surgery of the heart valves; (2) those in whom surgery is confined to the great vessels or to the exterior of the heart, as in coarctation of the aorta, patent ductus arteriosus, aneurisms, anastamoses, and non perforating wounds of the myocardium; and (3) those in whom surgery involves the major coronary arteries.

1-32. PREOPERATIVE CARE

a. Most patients scheduled for cardiovascular surgery enter the hospital several days prior to surgery. This allows for adequate time to prepare the patient for what lies ahead and adequate time for the staff to develop a rapport with the patient. Establishing a trusting relationship with the patient will provide him with emotional support.

b. A thorough assessment of the patient must be made. Many members of the health care team will be involved in this phase of preparation.

(1) The physician must complete a thorough physical examination and patient history. He orders the lab work, X-rays, ECGs, and other studies that must be done to obtain baseline data on the patient's immediate preopcondition.

(2) A nursing assessment of the patient must be done. This involves assessing the physical, psychological, social, and spiritual needs of the patient.

(3) The dietician may visit the patient to do a nutritional evaluation and teach the patient about his new postoperative diet.

(4) The physical therapist may visit the patient to instruct him in the postoperative procedures for his rehabilitation. Explanations will be given regarding the importance of advancing activity under the supervision of the staff, and exercise routines will be taught.

(5) An assessment must be made of the patient's coping mechanisms. This may be done by the chaplain, the psychologist, or most commonly, by the nursing personnel. Poor coping mechanisms mean increased anxiety for the patient, and increased anxiety leads to a slower recovery. Early identification of this problem will allow the nursing staff to make provisions for it in the nursing plan of care.

c. The nursing considerations in preoperative management include the following areas.

(1) The nursing staff executes the physician's orders, gathers data, and keeps the physician up to date regarding the patient's status.

(2) Patient education is implemented. The patient is instructed about his postoperative routine and the importance of his participation and cooperation during the postoperative course.

(3) The patient must be fully oriented to the postoperative environment. This includes familiarization with the monitors, machines, and equipment that will be used during the postoperative period. If possible, give the patient a tour of the CCU and allow him to meet some of the nursing personnel.

(4) Reduce patient anxiety by establishing a friendly informative, caring relationship with the patient.

1-33. POSTOPERATIVE CARE

Postoperative care for patients who have had surgery of the heart or great vessels is generally much the same as that given to other chest surgery patients. A possible exception to this generalization is care for the patient who has had surgery of the coronary arteries (see paragraph 1-33d below). The first 48 hours following cardiovascular surgery are the most critical, and a high degree of alertness and skill in nursing care are essential if death is to be prevented. Intensified nursing care should continue for at least the first five postoperative days.

a. **Vital Signs**. Pulse, blood pressure, and respiration must be taken and recorded every 15 minutes until they stabilize, usually after 4-8 hours. In addition, cyanosis must be watched for and its cause corrected. A systolic pressure of only 80 or 90 in cardiovascular (CV) surgical patients is no cause for alarm as these patients tolerate the lower pressure well. The physician should be called immediately if the systolic pressure is below 80. The exception is the coronary artery surgical patient, whose pressure should be not more than 10 mm. below the preoperative pressure. The apical pulse, taken over the heart with a stethoscope, most immediately reflects the activity of the heart; however, the arterial pulse should be taken not only from the radial artery at the wrist, but also from arteries of all limbs to detect the presence of an embolus as early as possible. Temperatures outside the 97° to 102°F range should be reported. Higher temperatures may be an indication of shock or cardiac decompensation. The respiratory character as well as the respiratory rate should be noted. Using the stethoscope aids in detecting changes in character. Changes noted should be reported promptly.

b. **Oxygen Therapy**. Oxygen is given by facemask, usually at the rate of 8 liters per minute. After the patient has fully reacted, a nasal cannula is substituted and oxygen is continued at 4 to 6 liters per minute until the physician orders discontinuance. Peripheral signs of cyanosis and ischemia must still be watched for, however. Mottling or blanching of the skin in an extremity--particularly if it is accompanied by other phenomena such as pain, numbness, tingling, or loss of motion--may indicate the presence of an embolus and should be immediately reported.

c. **Psychological Considerations**. Any signs of disorientation, such as failure to recognize a member of the family or familiar surroundings, should be reported. A transient state of depression may be expected in the CV surgical patient. In an occasional patient, the depression will degenerate into suicidal tendencies. Postoperative depression may be prevented or its intensity lessened through preoperative explanation of the upcoming procedure and sympathetic consideration of the patient's fears and concerns.

d. **Positioning and Turning**. Usually, the patient is kept in the dorsal recumbent position until his systolic pressure is more than 100. On specific orders from the physician, a CV surgical patient, other than one who has had coronary artery surgery, may be raised to a semi-Fowler position and may be turned from side to side

every two hours. A blood pressure reading must be taken immediately before and 5 minutes after the patient is raised. If the blood pressure drops after the patient is raised, the head of the bed and the patient must be returned to horizontal for at least 30 minutes before the procedure is repeated. The coronary artery patient is usually kept in dorsal recumbent position for 48 hours before any attempt is made to change his position because, up to that time, turning the patient as little as 15 degrees to one side may cause a serious drop in blood pressure. When turning is permitted, the coronary artery patient should be turned from back to right side (and vice versa) every 2 hours.

e. **Pain**. Ribs that were retracted during surgery are the major sources of postoperative pain in the CV surgical patient. During the first 24 to 48 hours, Demerol is given on a schedule and in a quantity sufficient to keep him reasonably comfortable but not enough to depress his mental outlook and cough reflex. After this initial period, other causes for continued restlessness--such as oxygen deprivation, fear, and positional discomfort--should be looked for and corrected.

f. **Cough**. After stabilization, CV surgical patients should be encouraged to raise deeply lodged secretions by coughing with support in the same manner as other surgical patients. Such coughing is usually effective, but if it is not, endotracheal suctioning must be employed. Sometimes a mucolytic agent applied in aerosol form may be helpful.

g. **Underwater Seal Drainage**. Nursing care with regard to CV patients with underwater seal drainage is generally the same as that for other chest patients with such drainage equipment in place. Drainage of about 400 to 500 ml of bloody fluid is to be expected from heart surgery patients during the first 24 hours. Absence of drainage fluid in the water seal setup indicates that fluid may be accumulating in the thorax. Thus, drainage volume must be carefully observed and recorded.

h. **Gastric Suction.** Temporary gastric distention is a common occurrence in CV surgical patients. The stomach is intubated and suction applied to reduce distention and relieve any pressure exerted on the heart by the distended stomach.

i. **Diet**. With permission of the physician, fluids may be given as soon as the patient can tolerate them. The first fluids given should be lukewarm and should not be fruit juices, as they may cause nausea. Cardiovascular surgical patients are normally markedly thirsty, and they will drink large quantities of fluids. If fluid is retained, intake may have to be restricted. Nursing personnel must diligently monitor and record fluid intake and output. Also, it may be necessary to weigh the patient daily. The physician probably will permit returning the patient to a soft or normal diet as soon as the patient desires solid food. Solid food should be withheld from the coronary artery surgery patient until abdominal cramps and gas no longer persist.

j. **Exercise**. The patient, upon regaining consciousness, is encouraged to breathe deeply through the nose deliberately and quietly to ventilate and expand the lungs. Care must be taken not to tire the patient. Other voluntary body movement and

exercise are encouraged after the first 24 hours. The patient is encouraged to comb his hair, reach for objects within normal reach, and then use a pull to raise himself. A pull may be made from wide gauze attached to the foot of the bed and extending to within the patient's reach. A T-handle may be inserted or a knot tied in the end of the pull to facilitate easier grasping. From about the 5th to the 8th day, as determined by the physician, the patient is allowed to dangle his feet for gradually increasing lengths of time, then gradually allowed out of bed more and more until the patient is fully mobile, usually by the 12th to 14th day.

1-34. COMPLICATIONS OF CARDIOVASCULAR SURGERY

As has been stated above, the first 48 postoperative hours are the most critical, and intensive care should be continued for several days until the patient is out of grave danger. Respiratory problems, hemorrhage, and shock are problems associated with any major insult to the body. The following paragraphs discuss complications associated with insult to the CV system in particular.

1-35. THROMBOPHLEBITIS

Thrombophlebitis is inflammation of a vein with blood clot formation. Venous stasis (slowing of venous blood circulation) and pressure or other injury to vein walls predisposes its development. The most common sites for development of thrombophlebitis are in the veins of the pelvis and legs. A postoperative patient or any other individual who has remained still for hours at a time with relaxed muscles and a resultant slowing of venous circulation in the legs is particularly liable to develop thrombophlebitis. When inactivity is combined with pressure on the popliteal space and the calf of the leg, the possibility of developing thrombophlebitis increases.

a. **Signs and Symptoms of Thrombophlebitis**.

(1) Cramping pain in the calf.

(2) Possible redness, warmth, and swelling along the course of the involved vein.

(3) Pain that may appear only on dorsiflexion of the foot.

b. **Nursing Implications**.

(1) Do not, under any circumstance, rub or massage the affected limb.

(2) Place the patient on immediate bed rest and notify the RN.

(3) Keep the affected limb horizontal and at rest until the physician has examined the patient and ordered specific treatment. Support the entire limb from the thigh to the ankle on pillows, keeping the limb level unless otherwise ordered. Orders for treatment may include elevation and application of continuous massive warm, moist packs to the entire limb.

(4) Use a bed cradle to prevent any pressure from the bed linen.

(5) Be alert to any complaint or other evidence of respiratory difficulty or chest pain. A clot which is adherent to the vein wall, or a portion of a clot, can become dislodged and be carried in the circulation as an embolus to distant and smaller arterial blood vessels in the lungs. Sudden dyspnea, violent coughing, or severe chest pain may be the first sign of embolism.

(6) Discontinue routine postoperative exercise, ambulation, deep breathing, and coughing measures until the physician has indicated which measures are to be resumed and which precautions are to be taken.

(7) Carry out all subsequent treatment and nursing care measures in a manner that will avoid abrupt movements and any strain on the part of the patient.

(8) When ordered, apply anti-embolism hose or intermittent external pneumatic compression system to give support and aid venous circulation.

(9) When the patient is allowed out of bed, remind him to alternate walking and resting with feet propped on a stool to avoid pressure in the popliteal space. Prolonged standing or sitting with no movement must be avoided. Check to see that the edge of the chair seat does not press the popliteal space and that the patient does not sit with crossed legs.

1-36. EMBOLISM

An embolus is a blood clot or other foreign particle (fat globule or air bubble) floating in the bloodstream. The embolus is usually undetectable until it suddenly lodges in an arterial blood vessel. This may occur when the patient is apparently convalescing and progressing normally. If the embolus is sufficiently large and the arterial vessel which it obstructs supplies a vital area in the lungs, heart, or brain, the patient may die before any symptoms of embolism are detectable. A special type of embolism, pulmonary embolism, is caused by the obstruction of a pulmonary artery by an embolus. The most frequent cause of a postoperative pulmonary embolism is a thrombosed vein in the pelvis or lower extremities. Therefore, measures to prevent development of thrombophlebitis are the most important ones to take to prevent the possibly fatal complication of pulmonary embolism.

a. **Signs and Symptoms**.

NOTE: May or may not be observable.

(1) Sudden signs of shock and collapse.

(2) Sudden, sharp, stabbing chest pain.

(3) Sudden violent coughing and hemoptysis (spitting of blood).

(4) Pain, blanching, numbness, or coldness in an extremity.

b. **Nursing Implications**.

(1) Notify the registered nurse (RN) immediately.

(2) Ensure absolute bed rest. Elevate head of bed to relieve respiratory distress.

(3) Prepare to start oxygen by mask at 6 to 8 liters per minute.

(4) Take and record blood pressure, pulse, and respiration.

(5) Prepare to give medication by injection to relieve pain and acute apprehension. A narcotic drug such as morphine sulfate or meperidine hydrochloride is often ordered.

(6) Prepare to continue intensive nursing care and constant observation. (The total care of the patient who survives a pulmonary embolism is similar to that of a patient who has had a myocardial infarction.)

1-37. ANTICOAGULANT DRUG THERAPY IN THROMBOPHLEBITIS AND EMBOLISM

a. **General**. Anticoagulant drugs such as heparin sodium and coumadin compounds lessen the tendency of blood to clot. They are frequently ordered as a part of the medical management of patients who have developed thrombophlebitis or who have survived an embolism.

(1) These drugs do not dissolve thrombi that have already formed, but are an important treatment measure to prevent extension of a clot within a blood vessel or to prevent further intravascular clot formation.

(2) Anticoagulant drugs act by prolonging the clotting time of blood.

(3) Since a patient who has once developed thrombophlebitis may have a recurrence, he may be continued on an anticoagulant drug indefinitely as a prophylactic measure.

b. **Medical Considerations.**

(1) Drug dosage is regulated very carefully by the physician, in relation to the individual patient's prothrombin determination. (Prothrombin determination is a special blood test.)

(2) Certain drugs should not be given with anticoagulants. Aspirin and aspirin-like drugs increase the effect of the anticoagulant. Phenobarbital and butazolidine decrease the effects.

c. **Nursing Implications.**

(1) Nursing personnel have a responsibility to recognize that any patient receiving an anticoagulant drug must be closely observed for bleeding.

(2) Bleeding may occur from the mouth, nose, urinary tract, or rectum.

(3) Patients receiving anticoagulant therapy should be encouraged to use a soft bristle toothbrush and an electric razor instead of a blade.

(4) Local policy often dictates that only the RN may administer anticoagulant drugs. This is due to the potential hazards and complicated dosage orders.

1-38. CARDIAC TAMPONADE

Bleeding into the pericardial sac, or accumulation of fluid in the pericardial sac, results in compression of the heart. This compression reduces heart movement, prevents adequate filling of the ventricles, and obstructs venous return to the heart. This condition, called cardiac tamponade, is an emergency that requires prompt relief to prevent death from circulatory failure.

a. **Signs and Symptoms**.

(1) Distention of the neck veins.

(2) Weak pulse.

(3) Low pulse pressure.

NOTE: Delayed distention of the neck veins should not be confused with the transitory distention seen postoperatively as the patient throws off unconsciousness produced by anesthesia. This distention is usually the result of straining.

b. **Nursing Implications**.

(1) Report signs and symptoms to the RN immediately.

(2) Monitor pulse and blood pressure.

(3) Administer oxygen as ordered for dyspnea.

(4) Assist with diagnostic procedures such as chest X-ray, ECG, or cardiac catheterization.

(5) Assist with procedures to relieve pressure and remove fluid such as thoracotomy or needle aspiration of the pericardial cavity.

1-39. RENAL FAILURE

a. Impairment of renal function may be caused by decreased cardiac output associated with open-heart surgery or by red blood count (RBC) hemolysis caused by the trauma of cardiopulmonary bypass.

b. Nursing implications when renal failure is suspected include the following:

(1) Strict and accurate recording of intake and output.

(2) Measurement of urine output on an hourly basis.

(3) If a urine output of less than 20 cc/hr is obtained, immediate notification should be made to the RN.

(4) Routine specific gravity of urine should be performed and recorded. (Specific gravity provides information relative to kidney function.)

1-40. MYOCARDIAL INFARCTION

a. A MI may occur during the postoperative period. Symptoms, however, may be masked by the postoperative pain being experienced by the patient.

b. Nursing implications include the following:

(1) A careful assessment of the patient's pain must be made in order to differentiate between routine postoperative discomfort and the pain associated with a myocardial infarction.

(2) If MI has occurred, nursing management of the patient will encompass both postoperative and post-MI nursing care considerations.

Section V. SUDDEN CARDIAC DEATH

1-41. CARDIAC ARREST

a. Cardiac arrest, also known as sudden cardiac death, is defined as the sudden, unexpected cessation of the heartbeat and circulation. This occurs when the heart action stops entirely or the heart fibrillates. Causes of sudden cardiac death include the following:

(1) Cardiac arrhythmias.

(2) Myocardial infarction.

(3) Shock.

(4) Drowning.

(5) Electrocution.

(6) Carbon monoxide poisoning.

(7) Anoxia.

b. The absence of peripheral pulses and heart sounds is all that is necessary to make the diagnosis. There is a period of about four minutes between the cessation of circulation and the onset of irreversible brain damage. For this reason, it is imperative that resuscitation begins immediately. Resuscitation requires that two basic life support functions be restored: blood must be pumped through the body and oxygen and carbon dioxide exchange must occur. Restoration of one function without the other is not adequate.

1-42. THE PARAPROFESSIONAL ROLE

a. The role of the nursing paraprofessional in cardiac arrest is one of extreme importance in saving a life, as the paraprofessional may be the first one to observe the emergency. It is necessary to have a well-planned course of action in mind at all times, in order to be prepared for an emergency. The nursing paraprofessional must:

(1) Be proficient in cardiopulmonary resuscitation (CPR).

(2) Be familiar with local standard operating procedures (SOP) for "CODE" procedures, including whom to call and how to reach them.

(3) Be able to locate and operate emergency equipment.

(4) Be ready to assist in the activities of code management at the direction of the physician or professional nurse.

b. The following items are found in a standard "crash cart."

(1) Emergency drugs.

(2) Intravenous infusion equipment.

(3) Needles and syringes.

(4) Intubation equipment, oral airways.

(5) Ambu bag with assorted masks and connecting tubing.

(6) Oxygen equipment.

(7) Suction equipment.

(8) Assorted dressing materials.

(9) There should be a defibrillator/cardiac monitor available if one is not located on or near the crash cart.

c. It is not necessary for the paraprofessional to be familiar with every single item that is found in a crash cart or emergency kit. It is important, however, to be familiar with the cart and the general layout of its contents. This will save precious time in an emergency. All paraprofessional nursing personnel should be proficient in the use of oxygen and suction equipment.

1-43. CODE

a. Sudden cardiac death and the ensuing hectic activity involved in code management can be a frightening and anxiety producing experience for nursing personnel who are unaccustomed to this type of event. A basic understanding of what takes place during a code will do much to alleviate that anxiety.

b. When a cardiac arrest has been identified:

(1) The person who witnesses the event or discovers the patient will call for help from his co-workers and immediately initiate CPR. The co-workers will respond by initiating the procedures for "calling" a code. They will then obtain the emergency equipment, take it to the location of the code, and relieve or assist the individual performing CPR. As help arrives, several things begin to happen simultaneously:

(a) An IV "lifeline" will be initiated.

(b) Blood pressure readings will be obtained.

(c) The patient is connected to the cardiac monitor.

(d) Baseline blood work is drawn to assess the patient's status.

(e) An ambu bag and oxygen will replace mouth-to-mouth resuscitation.

(2) The physician in charge will make decisions based on his observations of the patient's condition and the response to CPR. If there is no response to CPR, the code continues, and again, several things happen simultaneously:

(a) The patient will be intubated.

(b) Appropriate emergency drugs will be administered.

(c) Cardiopulmonary resuscitation is continued while the electrical activity of the heart is observed on the cardiac monitor. If appropriate to the patient's condition, the patient will be defibrillated.

(d) Blood samples are drawn repeatedly to monitor the effectiveness of the treatment. Acid-base balance and adequacy of oxygenation are of extreme concern.

(3) These procedures continue until the patient is stabilized or the physician makes the determination to declare the patient dead.

c. The seeming confusion of people is actually a coordinated effort by a group of people, each performing a particular task. The major roles are as follows:

(1) A physician will direct the activities, "managing" the code.

(2) A nurse will administer IV medications at the direction of the physician in charge.

(3) A nurse (or paraprofessional) will monitor blood pressure and obtain blood samples.

(4) One individual will perform chest compressions.

(5) One individual will administer artificial ventilation. This is normally the anesthesia specialist, who has intubated the patient.

(6) One individual will act as a recorder, charting the exact time of each action performed and each medication given.

(7) One or more individuals act as "runners," taking specimens to the lab, obtaining needed supplies, receiving lab reports, and so forth.

d. Remember, the purpose of a "code" is to attempt resuscitation of a patient whose heart has stopped pumping effectively (fibrillation) or stopped pumping altogether. Keep this purpose in mind at all times, and be aware of your role as a paraprofessional.

1-44. CONCLUSION

a. This lesson has introduced the basic nursing care techniques and procedures involved in the nursing care related to the CV system.

b. Review the lesson's objectives once again. If you feel confident that you have achieved the lesson objectives, complete the exercises at the end of this lesson.

c. If you do not feel that you have met the lesson objectives, review the necessary material before you attempt the end of lesson exercises.

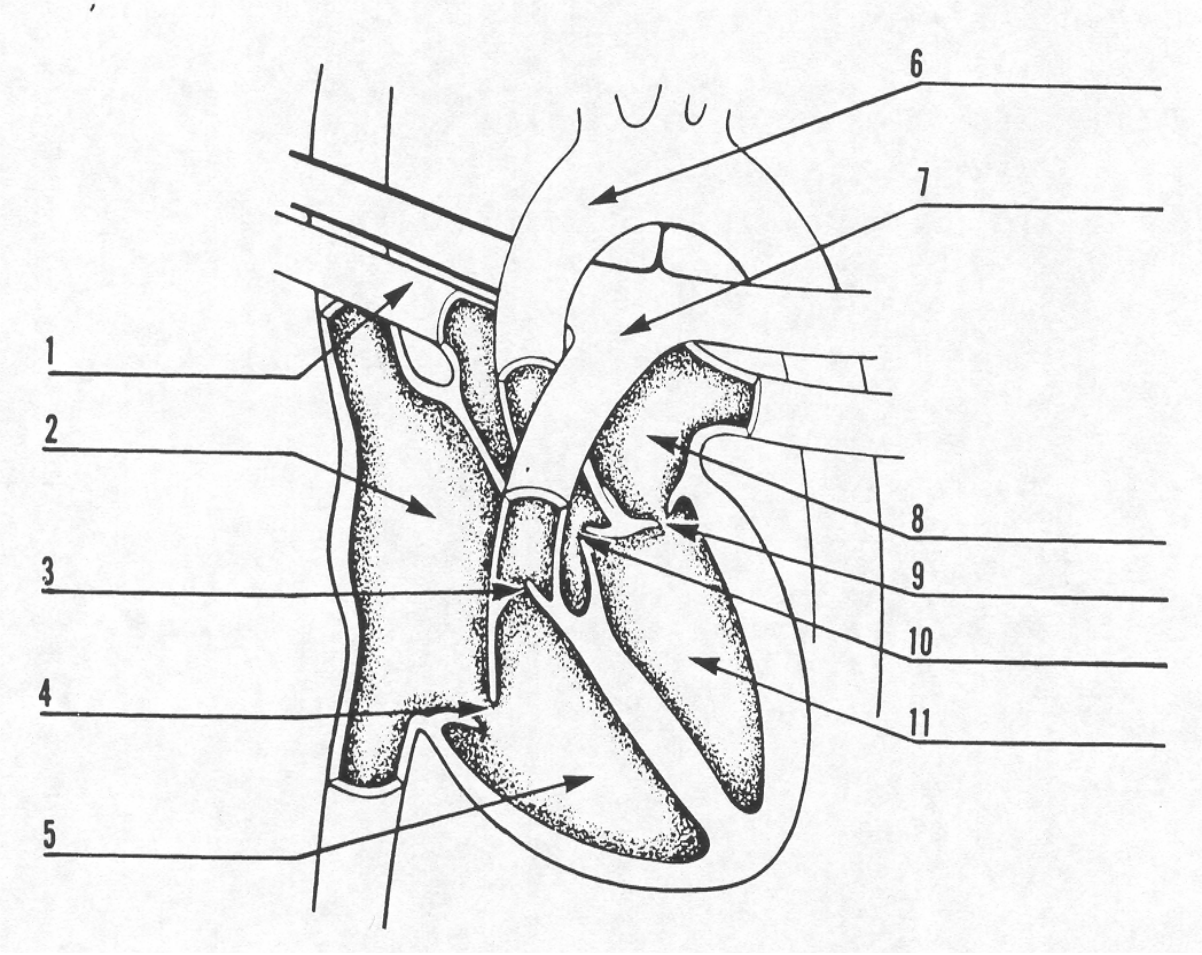
Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question, by completing the incomplete statement, or by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

SPECIAL INSTRUCTIONS FOR EXERCISES 1 THROUGH11. Exercises 1-11 should be answered by filling in the blanks to identify the heart structures in the figure below.



12. The two fluid transportation systems of the circulatory system are the _____ and the _____.

13. The chambers of the heart are lined with _____.

14. Blood from the upper part of the body enters the heart through a blood vessel called the _____.

15. Blood flows from the right ventricle into the _____.

16. Systemic circulation starts from the _____, and the pulmonary circulation starts from the _____.

17. The heart gets its blood supply from the _____.

18. The wave of expansion and recoil of an artery associated with the heartbeat is called the _____.

19. Cardiac fluoroscopy is used to show the heart in _____.

20. The procedure in which a radiopaque catheter is manipulated through the heart is called _____.

21. The graphic recording of the electrical impulses produced by the heart is called an _____.

22. The five major waves of the ECG are: _____, _____, _____, _____, and _____

23. Which ECG wave represents atrial depolarization?

    a. T

    b. P

    c. R

    d. Q

24. Which ECG wave represents electrical recovery of the ventricles?

    a. P

    b. R

    c. T

    d. S

25. The chest lead that is placed over the 5th intercostal space at the midclavicular line is the _____

26. The difference between the apical and radial pulse is called the _____.

27. _____ is the force or strength of the pulse.

28. List three terms used to describe the volume or force of a pulse.

    _____

    _____

    _____

29. Which of the following is NOT a factor that may affect pulse rate?

    a. Body temperature.

    b. Blood pressure.

    c. Digestion.

    d. Pain.

    e. None of the above.

30. The pressure that occurs during contraction of the ventricles is called _____

31. Fear, anger, or anxiety will cause blood pressure to _____.

32. The difference between the systolic and diastolic pressures is called the _____

33. The condition in which the coronary arteries cannot deliver adequate food supply to the heart is referred to as _____.

34. Which of the following is NOT a modifiable risk factor?

    a. Cigarette smoking.

    b. Weight.

    c. Sex.

    d. Stress.

35. _____ is the most common form of arteriosclerosis.

36. A clinical syndrome of ischemic heart disease, in which pain occurs in the chest or adjacent areas, is called _____

37. The pain of angina usually occurs during _____ and is relieved with _____.

38. A non-transmural myocardial infarction involves_____ _____

39. _____ is the greatest threat to life in the first hours after a myocardial infarction.

40. The clinical condition in which inadequate cardiac output results in poor perfusion of organ system is called_____

41. When increased pressure in the pulmonary vessels causes fluid to leak into the interstitial lung tissue, _____ occurs.

42. The condition manifested by neck vein distention and body edema is called _____

43. Hypertension that has no identifiable cause is referred to as _____ hypertension.

44. For a cardiovascular surgical patient, poor _____ result in increased anxiety, which leads to a slower recovery.

45. Cramping pain in the calf and the appearance of swelling or redness along a vein are signs of _____.

46. Compression of the heart from fluid accumulation in the pericardial sac is called _____.

47. Why is it essential for paraprofessional nursing staff to be familiar with the layout of a crash cart? _____.

48. What does the recorder do during a "code?" _____.

49. Sudden, sharp, stabbing chest pain and violent coughing in a post-operative CV surgical patient may indicate the present of _____.

50. Right sided heart failure without left sided failure is called _____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. Pulmonary vein (Figure 1-2)
2. Right atrium. (Figure 1-2)
3. Pulmonary valve. (Figure 1-2)
4. Tricuspid valve. (Figure 1-2)
5. Right ventricle . (Figure 1-2)
6. Aorta. (Figure 1-2)
7. Pulmonary artery. (Figure 1-2)
8. Left atrium. (Figure 1-2)
9. Mitral valve. (Figure 1-2)
10. Aortic valve. (Figure 1-2)
11. Left ventricle. (Figure 1-2)
12. Cardiovascular system, lymphatic system. (para 1-1a, b)
13. Endocardium or endocardial tissue . (para 1-2d)
14. Superior vena cava. (para 1-3)
15. Pulmonary artery. (para 1-3b)
16. Left ventricle; right ventricle. (para 1-3e)
17. Coronary arteries. (para 1-4a)
18. Pulse. (para 1-6a)
19. In action (or motion). (para 1-12)
20. Cardiac catheterization. (para 1-15 b)
21. Electrocardiogram. (para 1-16a)
22. P, Q, R, S, T. (para 1-16b)

23. b. (para 1-16b)

24. c. (para 1-16b)

25. V4 lead. (para 1-16e)

26. Pulse deficit. para 1-19c)

27. Pulse volume. (para 1-19d)

28. Weak, thready, feeble, bounding, full, or strong. (para 1-19d)

29. e. (para 1-19e)

30. Systolic (or systole). (para 1-20b)

31. Increase (rise). (para 1-20d)

32. Pulse pressure. (para 1-20g)

33. CAD (coronary artery disease). (para 1-21)

34. c. (para 1-22a)

35. Atherosclerosis. (para 1-23b)

36. Angina pectoris. (para 1-25a)

37. Exertion; rest. para 1-25c)

38. Only partial thickness of the myocardial muscle. (para 1-26b)

39. Ventricular fibrillation. (para 1-26d)

40. Heart failure. (para 1-27a)

41. Pulmonary edema. (para 1-27b)

42. Congestive heart failure. (para 1-27c)

43. Primary or essential. (para 1-29b)

44. Coping mechanisms. (para 1-32b(5))

45. Thrombophlebitis. (para 1-35a)

46. Cardiac tamponade. (para 1-38)

47. To save time in an emergency. (para 1-42c)

48. Chart the exact time of each drug given and each procedure performed. (para 1-43c)

49. Embolism. (para 1-36a)

50. Corpulmonale. (para 1-27d)

END OF LESSON 1

LESSON ASSIGNMENT

LESSON 2 Nursing Care Related to the Respiratory System.

TEXT ASSIGNMENT Paragraphs 2-1 through 2-50.

LESSON OBJECTIVES After completing this lesson, you should be able to:

2-1. Describe the components of the respiratory system.

2-2. Describe the physiology of respiration.

2-3. Describe the mechanics of respiration.

2-4. Describe the factors involved in an accurate respiratory assessment.

2-5. State the purposes of percussion.

2-6. Describe the procedure used to administer percussion.

2-7. Explain the purpose of incentive spirometry.

2-8. Name one method used in the nursing management of epistaxis.

2-9. Identify the types of devices used to administer oxygen to a patient.

2-10. Describe the steps for suctioning the nasopharynx or oropharynx.

2-11. Describe the steps for endotracheal suctioning.

2-12. State three reasons for endotracheal intubation.

2-13. List the postoperative nursing management considerations for a patient undergoing tonsillectomy and adenoidectomy.

2-14. List the nursing considerations involved in the care of a patient with a new tracheostomy.

2-15. Describe the steps used in tracheostomy suctioning.

2-16. Explain the principle of underwater seal drainage.

2-17. Describe three systems used for underwater-seal drainage.

2-18. Discuss the nursing techniques used in management of underwater-seal drainage.

2-19. Discuss the nursing management of a patient with a chest tube.

2-20. State the purpose of thoracentesis.

SUGGESTION

After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

NURSING CARE RELATED TO THE RESPIRATORY SYSTEM

Section I. ANATOMY AND PHYSIOLOGY

2-1. INTRODUCTION

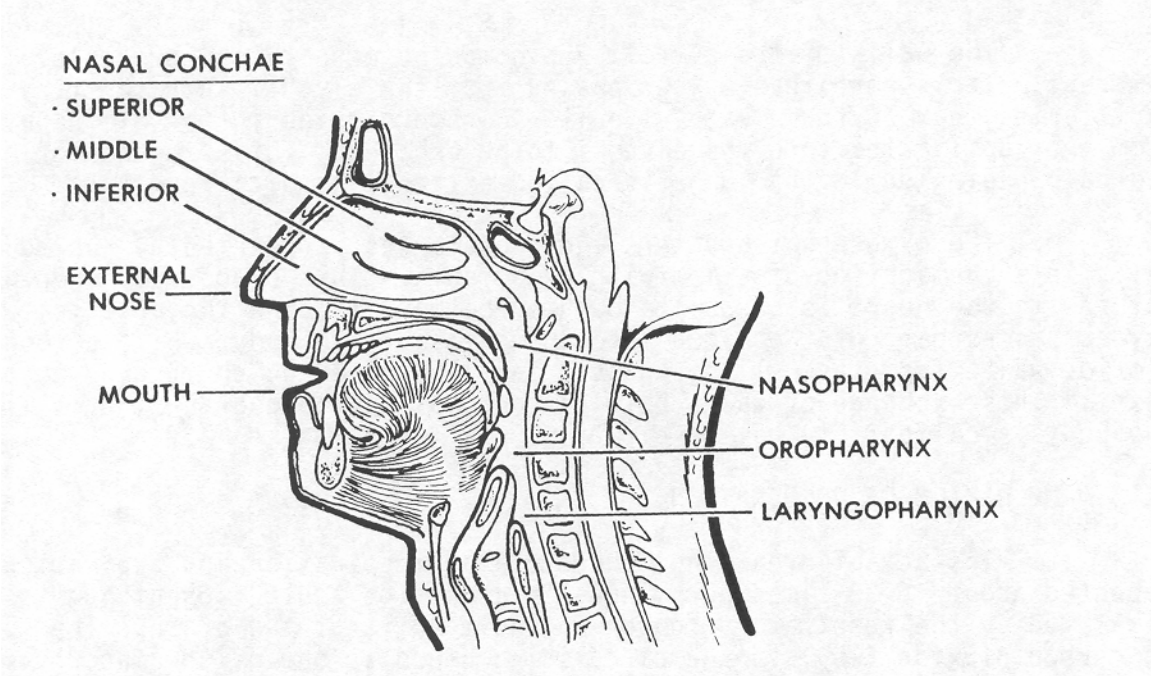
a. The respiratory tract is the most common portal of entry and exit of microscopic disease agents. Many of these microorganisms leave the body of the infected person by means of droplets and by nose and throat secretions. Droplets are exhaled in coughing, sneezing, talking, or simply breathing. These droplets do not always fall to the ground immediately, but may remain suspended in the air for many hours and can be inhaled by a well person, who may then become infected. The infection may also be spread to a well individual who improperly handles secretions of the nose and throat of an infected person. Many respiratory diseases are infectious in nature and are easily spread.

b. Medical intervention and skilled nursing care are employed in treating respiratory infections. Skilled nursing care includes knowledge of the duration and stages of the disease, isolation procedures, infection control policies, comfort measures for the patient, therapeutic measures, and observation of signs, symptoms, and potential complications.

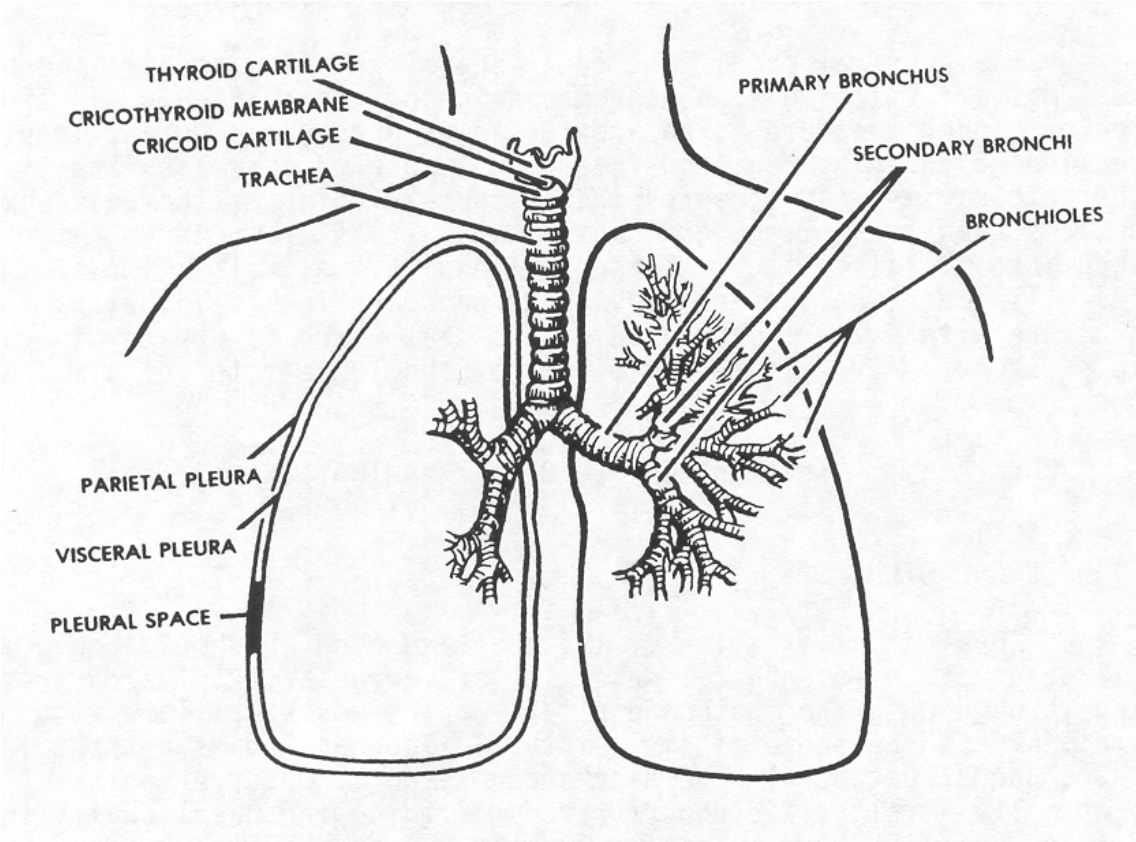
2-2. THE RESPIRATORY SYSTEM

a. The cells of the body require a constant supply of oxygen to carry on the chemical processes necessary to life. As a result of these processes, carbon dioxide, a waste product, is formed, and must be removed from the body. Oxygen and carbon dioxide are continually being exchanged, both between the body and the atmosphere and within the body. This process is known as respiration, and the body system that performs this exchange of gases is the respiratory system.

b. The respiratory system is a continuous series of passages that begins with the nose and ends in the alveoli of the lungs. The upper respiratory system includes the nose, pharynx, larynx, and the trachea. The lower respiratory system includes the right and left bronchi, their subdivisions, and the lungs. Review Figure 2-1 as you read the next paragraph.



(Upper respiratory system)



(Lower respiratory system)

Figure 2-1. The human respiratory system.

2-3. STRUCTURE AND FUNCTION

a. **Nose.** Inhaled air is warmed, moistened, and filtered in the nasal cavities. Filtering is done by the cilia (tiny hair-like projections) of the mucous membrane lining the nasal passages.

b. **Pharynx.** The pharynx, or throat, connects the nose and mouth with the lower air passages and the esophagus. It is divided into three sections, the nasopharynx, the oropharynx, and the laryngopharynx. Both air and food pass through the pharynx. Air passes from the nose and mouth to the larynx, while food passes from the mouth to the esophagus. The walls of the pharynx contain masses of lymphoid tissue called the adenoids and tonsils.

c. **Larynx.** The larynx, or voice box, connects the pharynx with the trachea. Two membranous bands in the wall of the larynx are called vocal cords. Vibrations of the vocal cords produce sound.

d. **Trachea.** The trachea, or windpipe, is a tube that carries air from the larynx to the bronchi. It is held open by cartilaginous rings and is lined with cilia and mucous glands to keep dust and dirt out of the lungs.

e. **Bronchi.** The trachea divides to form the two main bronchi. One bronchus enters each lung and divides into many smaller air passages called bronchioles. The bronchioles terminate in the final air spaces, called the alveoli.

f. **Lungs.**

(1) The lungs are the organs of respiration. They are elastic structures contained within the thoracic cavity. The upper, pointed border of each lung, called the apex, extends above the clavicle. The lower border, or base, rests upon the diaphragm. Each lung is divided into sections called lobes. The right lung has three lobes, termed upper, middle, and lower. The left lung has only two lobes, referred to as upper and lower. Inside each lung, millions of tiny air sacs, called alveoli, are interlaced in a network of capillaries. Certain cells in the alveolar walls secrete a lipid-rich material called surfactant. Surfactant helps to maintain the elastic quality of the alveolar membrane and assists with the transfer of gases.

(2) Oxygen-poor blood is pumped from the heart's right ventricle, through the right and left pulmonary arteries, and into the lungs. Paralleling the branching of the respiratory tree, the arteries divide and subdivide within the lungs. Arteries divide into arterioles, and arterioles divide into the capillaries that surround the alveoli.

(3) Each lung is enclosed by a membranous sac formed of two layers of serous membrane called pleura. One layer covers the lungs and is called the visceral pleura. The other lines the chest cavity and is called the parietal pleura. The space between the two layers, the pleural cavity, contains a small amount of fluid that

lubricates the surfaces. Between the two lungs is the mediastinum, the central thoracic cavity containing the heart, the great vessels, the esophagus, and the lower trachea.

2-4. PHYSIOLOGY OF RESPIRATION

a. The walls of the alveoli are composed of a thin, permeable membrane. It is here that oxygen passes from the alveoli into the tiny capillaries that surround each alveoli. Carbon dioxide in the blood passes from the capillaries into the alveoli to be exhaled. This exchange of oxygen and carbon dioxide in the lungs is called external respiration.

b. The oxygen that enters the capillaries is carried by the red blood cells in a chemical combination with hemoglobin. This blood, now oxygenated, returns to the heart to be pumped out to the body through the arteries. The oxygen passes part of the blood into the cells of the body, while carbon dioxide waste from the cells is passed into the blood that returns to the heart. This exchange of gases between the capillary blood and the cells of the body is called internal respiration.

2-5. MECHANICS OF RESPIRATION

a. The act of breathing, the cycle of inspiration and expiration, is repeated about 16-20 times per minute in a resting adult. Breathing is regulated by the respiratory center in the medulla of the brain. The level of carbon dioxide (CO) in the circulating blood is one of the major influences upon the respiratory reflex. The respiratory center is sensitive to changes in blood composition, temperature, and pressure, and will adjust the rate and depth of breathing to accommodate the body's needs.

b. The physical conditions that control the flow of air into and out of the lungs are referred to as the mechanics of ventilation. Air flows from an area of higher pressure to an area of lower pressure. During inspiration, contraction of the diaphragm and intercostal muscles increases the size of the thoracic cavity. This causes the pressure within the thoracic cavity to become less than that of the atmosphere, and air is drawn through the air passages into the alveoli. During normal expiration, relaxation of the same muscles will cause the thoracic cavity to decrease in size, thereby increasing the pressure within the thoracic cavity to that which is greater than atmospheric pressure. Air will then flow out of the lungs into the atmosphere.

Section II. PHYSICAL EXAMINATION

2-6. NOSE AND SINUSES

a. Physical examination of the nose and sinuses should begin with an overall observation for general deformity or irregularity. Watch the patient breathe through both the mouth and nose. Do the nostrils flare with inspiration? Is the sense of smell intact? The nasal passages should be clear and unobstructed, with no discharge present. Observe the nasal septum. It is normally straight and un-perforated, dividing the nasal cavity into two chambers of relatively equal size and shape. The mucous membranes should be pink.

b. Examine the sinuses for tenderness. Avoiding the eyes, use the fingertips to direct manual pressure upward over the frontal sinuses. With the thumbs, direct pressure upward over the lower edge of the maxillary bones to examine the maxillary sinuses.

2-7. MOUTH AND THROAT

a. When examining the mouth and throat, begin with a general observation of the voice quality. Are raspines or hoarseness detected in the voice? Make a note of the breath odor. Observe the lips for moisture, color, and the presence of abnormalities such as masses, lesions, or discolorations.

b. Using a tongue depressor and penlight, examine the inside of the mouth.

(1) Note the number and condition of the teeth.

(2) Note the color and texture of the gums and look for the presence of swelling or discharge.

(3) Observe the pharynx, looking for masses, exudate, or inflammation.

(4) Observe the tonsils for inflammation or exudate.

(5) Observe the protruded tongue for size, color, moisture, symmetry, and the presence of any abnormal lesions.

2-8. RESPIRATIONS

a. The normal resting adult breathes 16-20 times per minute. Except for an occasional deeper breath (sigh), breathing is maintained at a fairly regular rate, rhythm, and depth. Any disease or injury that affects the respiratory system, the chest wall, or the oxygen carrying ability of the blood will usually affect the respiratory rate or the effort required to breathe. If breathing movements are painful, breathing may become irregular or the patient may be reluctant to take a breath of sufficient depth to aerate the lungs.

b. When observing a patient's respirations, the following should be noted.

(1) Rate. The number of breathes per minute.

(2) Rhythm. The pattern or regularity of the breathing.

(3) Depth. Shallow or deep inspiration.

2-9. ABNORMAL RESPIRATIONS

a. **Dyspnea.** Difficult or labored breathing, normally requiring considerable exertion by the patient.

b. **Apnea.** Temporary cessation of breathing. A period of apnea may last for 30-60 seconds.

c. **Tachypnea.** Quick, shallow breathing.

d. **Bradypnea.** Abnormal slowness of breathing.

e. **Hypoventilation.** A state in which there is a reduced amount of air entering the pulmonary alveoli.

f. **Hyperventilation.** A state in which there is an increased amount of air entering the pulmonary alveoli.

g. **Stertorous Respiration.** Breathing accompanied by abnormal snoring sounds.

h. **Cheyne-Stokes Respiration.** An irregular rhythmic breathing pattern that begins with slow, shallow respirations that increase in rate and depth and then gradually decline again. A period of apnea lasting 10-60 seconds follows, and the pattern then repeats itself.

2-10. CHEST AUSCULTATION

a. Auscultation (listening with a stethoscope) aids in assessing air flow through the lungs and determining the presence of fluid or mucus. Breath sounds vary according to the proximity of the large bronchi. Sounds are louder and courser near the large bronchi and over the anterior chest in general. Peripherally, the sounds are softer and finer.

b. To auscultate the chest, have the patient sit erect, or position the patient first on one side and then on the other if the patient is unable to sit. With a stethoscope, listen to the lungs as the patient breathes in and out with the mouth open. Follow a methodical pattern, comparing symmetrical areas on the left and right, traveling from apex to base. Listen both anteriorly and posteriorly.

c. Breath sounds, the sounds of air moving into the lungs during inspiration and out during expiration, should be clearly heard over all lung fields. Normal breath sounds are smooth and clear. Wheezing, rattling noises, or the absence of sound over a particular area is abnormal.

d. Nursing personnel should always auscultate the patient's lungs before and after percussion or coughing and deep breathing exercises. In this way, an observation regarding the effectiveness of the treatment can be made.

Section III. DIAGNOSTIC STUDIES

2-11. LABORATORY STUDIES

a. Sputum is collected and studied for the presence of white blood cells, bacteria, and abnormal cells. Cultures of sputum may be done to determine sensitivity or resistance to drugs when the physician must choose an antibiotic therapy.

b. Pleural fluid will accumulate in the parietal cavity in abnormal amounts in certain disease conditions. The fluid is studied to determine the cause of the abnormal accumulation. Pleural fluid is normally obtained by aspiration. This procedure is called thoracentesis and will be discussed in another section.

c. Arterial blood gas (ABG) studies provide a means of assessing the adequacy of ventilation and oxygenation, and help assess the acid-base state of the body.

2-12. OTHER STUDIES

a. X-rays of the chest show the position of normal structures within the thorax. Displacement of structures, abnormal shadows, or abnormal densities are indicative of some abnormal pathology.

b. Pulmonary function tests (PFTs) are ventilatory function tests done to detect and measure abnormalities in respiratory function. These tests involve measurement of the amount of air the patient is able to inhale and exhale.

c. Bronchoscopy is the direct visualization of the larynx, trachea, and bronchi through an instrument called a bronchoscope. Bronchoscopes may be flexible or rigid.

The bronchoscope is used not only to examine, but also to diagnose bleeding sites, to excise lesions, to remove obstructions or secretions, and to collect specimens for biopsy, cytologic, or bacteriologic study.

Section IV. SPECIAL NURSING MANAGEMENT

2-13. COUGHS AND DEEP BREATHE

a. Unless contraindicated, coughing is encouraged in order to clear mucous secretions from the trachea and bronchi. If secretions are allowed to accumulate, they block the air passages and prevent air from reaching lung tissue. Effective coughing, deep breathing, and change of position are all measures that help to promote complete aeration of lung tissue in bedridden, debilitated, and postoperative patients. When

coughing is prescribed, teach and assist the patient to cough effectively. It can often be a painful experience, and the patient may try to suppress the cough, give a small "hacking" cough, or merely clear his throat. The patient can cough most effectively in the sitting position.

b. Using good body mechanics assist the patient to sit upright in bed or in a stable straight-backed chair. If the patient is unable to sit up, assist him to a supine position and raise the head of the bed if permissible. Provide tissue and an emesis basin for the expectorated secretions. Instruct the patient to inhale deeply, cough on exhalation, and expectorate the coughed-up secretions into the tissue or basin. Repeat the procedure several times in order to clear the air passages. Assist the patient into a comfortable position and document the results of the procedure.

2-14. PERCUSSION

a. Percussion, a method of tapping massage, is done to mobilize secretions, to aid in expansion of lung tissue, and to promote efficient use of respiratory muscles.

b. Prior to administering percussion, review the patient's chart to determine the reason or purpose for the treatment. Familiarize yourself with the patient's diagnosis and condition. Discuss the procedure with the patient and assemble the necessary equipment.

(1) Suction equipment, if necessary, to remove secretions that cannot be expectorated.

(2) Towels.

(3) Tissues.

(4) Toothpaste, toothbrush, basin.

(5) Pillows to help support the patient in the desired position.

2-15. PRECAUTIONS

When administering percussion, it is necessary to observe the following precautions:

a. Avoid fatiguing the patient by modifying positions according to the patient's tolerance.

b. Avoid performing percussion immediately before or within one hour after meals to avoid nausea, vomiting, and aspiration.

c. Avoid percussing over the spine, liver, kidneys, or spleen to avoid injury.

d. Avoid percussing over a female patient's breasts.

e. Place a towel over the bare skin or percuss over the patient's clothing. Do not percuss over buttons, snaps, or zippers.

f. Remove rings or any other jewelry that might scratch or bruise the patient.

2-16. PERCUSSION PROCEDURE

a. Prior to the start of the treatment, auscultate the patient's lungs to locate the areas of congestion. Position the patient in the posture that best facilitates drainage of the areas to be percussed. Instruct the patient to breathe slowly and deeply to promote relaxation.

b. Hold your hands in a cupped shape with the fingers flexed and the thumbs pressed tightly against the index fingers.

c. Using a tapping or clapping movement of your cupped hands against the torso, percuss the selected area in a rhythmic manner. A hollow sound indicates correct performance of the technique. Percuss each area one to two minutes.

d. After completion of percussion, instruct the patient to breathe deeply and cough to remove loosened secretions.

e. Auscultate the patient's lungs to evaluate the effectiveness of the treatment.

2-17. INCENTIVE SPIROMETRY

a. An incentive spirometer is a device that stimulates the patient to achieve maximum voluntary lung expansion. The purpose of the device is to help the patient achieve deeper inspirations.

b. In performing the exercise, the patient places his lips securely over the mouthpiece of the spirometer and inhales as deeply as possible. At maximum inflation there should be a slight pause, and the patient then relaxes and exhales.

c. The spirometer is normally equipped with a visual reinforcement device for patient encouragement. For example, a light may come on at maximum inspiration or the patient may watch a plastic ball rise to the top of a chamber during inspiration.

d. The patient should be encouraged to cough and expectorate any secretions loosened by the deep breathing.

2-18. OXYGEN THERAPY

a. Oxygen is a colorless, tasteless, odorless gas that is slightly heavier than air. Oxygen may be delivered by various administrative devices. The method of delivery

selected depends upon the condition of the patient, the concentration of oxygen required, and the preference of the physician. The following equipment will be necessary:

(1) Oxygen source (O2 tank o piped-in wall outlet)

(2) A cylinder regulator (O2 tank) or a flow meter (wall O2)\

(3) Humidifier.

(4) Sterile or distilled water.

(5) Administration device.

b. Administration devices include:

(1) A nasal cannula is a rubber or plastic tube with short curved prongs that extend into the nostrils about 1/4 to 1/2 inch. The cannula is held in place with an elastic band that fits around the patient's head. It is used to administer low to medium concentrations of oxygen. A flow rate of 2-6 liters/minute should provide an oxygen concentration of 25-35 percent. Start the oxygen flow prior to inserting the prongs into the patient's nostrils.

(2) A venturi mask is a facemask designed to deliver precisely controlled oxygen concentrations by providing oxygen mixed with room air. A fixed flow of oxygen is mixed with a flow of air to produce a constant oxygen concentration regardless of rate of breathing. Masks are designed to provide 24 percent, 28 percent, 31 percent, 35 percent, 40 percent, and 50 percent oxygen concentrations. The mask should be assembled according to the manufacturer's instructions for the oxygen concentration prescribed by the physician. Start the oxygen flow at the specified flow rate and adjust the mask over the patient's nose and mouth.

(3) A simple facemask is designed to provide low to medium oxygen concentration using liter flow rates of 2-8 liters/minute. Simple masks come in many sizes and configurations. Follow the manufacturer's instructions for use of the mask. Always begin the oxygen flow prior to placing the mask over the patient's nose and mouth.

(4) Re-breathing masks are designed for inhalation of moderately high concentrations of oxygen from a reservoir bag. A partial re-breathing mask has perforations on both sides of the mask that serves as exhalation ports. Inspired oxygen concentrations of 50-60 percent can be achieved. The non-re-breathing mask differs from the partial re-breathing mask in that it has a one-way valve between the mask and the reservoir bag that ensures that the patient receives only 100 percent oxygen from the reservoir bag. The mask has two flapper valves over the exhalation ports that allow the patient to exhale, but prevent inhalation of room air that would dilute the oxygen concentration.

(5) A T-tube is a device that connects directly to an endotracheal or tracheostomy tube to deliver humidified oxygen. Connecting tubing runs from the T-tube to the humidification device, which is connected to the oxygen source.

c. Safety precautions associated with the use of oxygen include:

(1) Post "Oxygen" and "No Smoking" signs wherever oxygen is stored or in use. Oxygen supports combustion, so things that burn slowly in normal air will burn violently or explosively in the presence of increased oxygen.

(2) Inform the patient and visitors of requirement for no smoking and no open flames. Enforce this rule.

(3) Ensure that oil or grease isn't used around the oxygen fittings, as petroleum-based products will burn.

(4) Ensure that all electrical equipment is properly grounded and in good condition.

(5) Avoid the use of static-generating materials such as nylon and wool. This applies to uniforms, pajamas, and bedding.

(6) If an oxygen tank is used, secure it away from doors and high traffic areas to reduce the possibility of the cylinder being knocked over and the valve being damaged.

(7) When transporting an oxygen cylinder, strap it to the carrier. An unsecured cylinder may drop or fall, causing injury to patients or staff, and damaging equipment, walls, and flooring. If the valve should break, the sudden release of the high pressure could cause the cylinder to become a high velocity missile. A full oxygen cylinder has enough force to penetrate a concrete wall.

2-19. NASOPHARYNGEAL AND OROPHARYNGEAL SUCTIONING

a. The nose, mouth, and throat may be cleared of mucus, vomitus, blood, or other material by a procedure called suctioning.

(1) Material that accumulates in the mouth and throat can usually be expectorated. Mucus accumulations in the nostrils can be removed by blowing the nose. If the patient is unable to cough, expectorate, or otherwise clear the upper air passages effectively, there is a danger that the accumulated material may be aspirated into the lower air passages (trachea, bronchi, and lungs).

(2) These suctioning procedures may be carried out using medical asepsis (clean technique) since the nostrils, mouth, and throats are not sterile areas. In specific cases, such as isolation, sterile technique may be required.

b. Wash your hands and assemble the necessary equipment. Set it up at the patient's bedside.

(1) Set up the suction apparatus (portable suction machine or in-wall suction) and connect a sufficient length of tubing to reach easily from the suction source to the patient.

(2) Place a container of water (or normal saline solution), 4x4 gauze squares, an emesis basin, and tissues on the bedside table.

(3) Select the appropriate size catheter (14 or 16 French for adults, 10 or 12 French for children) and attach it to the suction tubing. If the catheter does not have a thumb control suction valve, attach it to the tubing with a Y-connector.

(4) Turn on the suction apparatus and check the suction and the patency of the tubing by aspirating some of the water through the catheter. Do this by inserting the free end of the catheter into the container of water. Apply suction by placing your thumb over the suction control (thumb control valve or Y-connector).

c. Suction of the nasopharynx and nostrils:

(1) Moisten the catheter in the water.

(2) With suction diverted, insert the catheter gently through a nostril to the back of the throat (about 3-5 inches).

Note: If an obstruction is met, or if the patient's cough reflex is stimulated, remove the catheter and wait a moment before reinserting.

(3) Apply suction and slowly remove the catheter, using a rotating motion. Remember: You are suctioning oxygen as well as secretions, so suction for only 5-10 seconds at a time.

(4) Clear the catheter by aspirating some water through it. Thick secretions adhering to the outer surface of the catheter should be removed with moistened gauze.

(5) Repeat the procedure through the other nostril.

d. Suction of the oropharynx and mouth:

(1) Moisten the catheter in the water.

(2) With suction diverted, insert the catheter gently into the mouth toward the back of the throat. Note: If gag or cough reflexes are stimulated, remove the catheter and wait until gagging or coughing subsides before reinserting.

(3) Apply suction and rotate the catheter to suction the secretions. Suction for only 5-10 seconds at a time. Do not push the catheter in and out against the wall of the throat as this may injure the mucous membrane.

(4) Withdraw the catheter and clear it by aspirating water through it. Thick secretions adhering to the outer surface of the catheter should be removed with moistened gauze.

(5) Repeat the procedure, suctioning around the teeth and gums and under the tongue if secretions have accumulated in these areas.

(6) For suctioning of the mouth, a firm metal suction tip may be used instead of a soft catheter. One such tip is the Yankauer. Care must be taken when using a rigid suction tip to avoid injury to the oral mucosa.

e. Bulb syringe suctioning is used to clear secretions from the nose and mouth of infants.

(1) Grasp the bulb syringe firmly and squeeze the bulb to expel the air.

(2) Very gently, insert the tip into the mouth or nostril of the infant, taking care not to injure the delicate mucosa.

(3) Release the pressure on the bulb. As the air returns into the bulb, it creates a sucking action that will withdraw the secretions.

(4) When the bulb has inflated, remove the tip from the infant's mouth or nose. Dispose of the secretions into a basin or piece of gauze by squeezing the bulb, forcing out the air and secretions.

(5) Repeat the procedure as necessary.

(6) Rinse the syringe as necessary and at the end of the procedure. Squeeze the bulb, insert the tip into a basin of water, and release the bulb to aspirate the water. Remove the tip from the basin and squeeze the bulb to expel the water.

2-20. ENDOTRACHEAL SUCTIONING

a. The procedures for endotracheal (within the trachea) suctioning are similar to those used for naso and oropharyngeal suctioning with two major differences.

(1) Endotracheal suctioning, unlike naso- and oropharyngeal suctioning, is done as an aseptic, or sterile, procedure.

(2) Suctioning the trachea interferes greatly with oxygenation. A high suction pressure and a lengthy suctioning time will greatly decrease the amount of

oxygen in the alveoli. If the patient is old or greatly debilitated, suctioning has the potential to set off cardiac arrhythmias.

b. Wash your hands, then assemble and set up the suction equipment.

(1) Check the suction and the tubing by aspirating water through the connecting tubing.

(2) On the bedside table, place an open package of 4x4 gauze, a sterile suction catheter, a suction set or sterile basin, a container of sterile water or normal saline, and sterile gloves.

(3) Set up the suction set or sterile basin. Fill the sterile container with the sterile water or normal saline.

c. Using aseptic technique, open the catheter package just enough to expose the connecting end and connect the catheter to the suction tubing. Don the sterile gloves. Using aseptic technique, remove the catheter from the package and hold it in your dominant hand. Test the catheter by aspirating some of the sterile solution.

d. Pick up a piece of the gauze with your non-dominant hand and grasp the patient's tongue. Gently pull the tongue out of the mouth. This will provide a view of the oropharynx and at the same time raise the epiglottis to permit easier insertion of the catheter into the trachea. As an alternative method, the catheter may be introduced through the nose.

e. As the patient inhales, introduce the catheter (with suction diverted) toward the posterior of the mouth and down the throat into the trachea. The patient will probably cough at this point. If coughing brings up sufficient secretions to clear the air passages, the procedure may be discontinued at this point. If not, relax the tongue a bit and instruct the patient to breathe normally.

f. Apply suction and gently rotate the catheter to aspirate secretions. Remember to suction for only 5-10 seconds at a time. Withdraw the catheter and rinse between suctioning by aspirating sterile solution. This will keep the catheter moist and free of secretions that may block the lumen.

g. Repeat the procedure until the secretions have been cleared. Remember that frequent catheter introductions irritate the tracheal mucosa, so suction thoroughly to avoid repeated insertions.

h. Observe the patient closely for changes in color or respiration, disorientation, or agitation. These could be signs of anoxia. Listen to the patient's breath sounds, which should become quieter as secretions are removed.

2-21. ENDOTRACHEAL INTUBATION

a. An endotracheal tube may be inserted through the nose or mouth into the trachea. This procedure is normally done by a physician or a nurse anesthetist. Endotracheal intubation may be done during surgery to facilitate anesthesia and control respirations, to bypass an upper airway obstruction, or to permit connection of the patient to a resuscitation bag or mechanical ventilator.

b. Endotrachial (ET) tubes generally have an inflatable cuff, which holds the tube in place in the trachea and prevents aspiration of upper respiratory tract secretions into the lower respiratory tract. The cuff must be deflated periodically to prevent injury to the trachea.

c. If intubation is necessary for an extended period of time, a tracheotomy is performed and the patient is intubated with a tracheostomy tube. This surgical procedure will be discussed in section VI.

2-22. MECHANICAL VENTILATION

a. When a patient is unable to maintain appropriate levels of arterial oxygen and carbon dioxide by normal breathing, some sort of mechanical assistance becomes necessary. A mechanical ventilator is a positive pressure-breathing device that maintains respirations automatically. Ventilators may be used for complete or partial control of a patient's respirations.

b. Mechanical ventilators are used in three modes of operation: assist, control, and assist-control. Determination is made by the physician according to the needs of the patient.

(1) Control mode is used for the patient whose respiratory drive is absent or excessive. The ventilator initiates breathes at a pre-set rate and will not respond to any patient attempts to initiate a breath.

(2) Assist mode is used for the patient who is able to make an inspiratory effort, but is unable to inhale an adequate amount of air. The patient initiates each breath and the ventilator then augments the breath to achieve a preset volume of air.

(3) Assist-control mode is used for the patient who has an erratic respiratory pattern. The ventilator will function in assist mode as long as the patient maintains an adequate respiratory rate. If the patient's respiratory rate falls below a preset level, the machine will switch to control mode and initiate breaths. The ventilator will switch from assist to control as determined by the needs of the patient.

c. The ventilator settings are determined by the physician.

(1) Tidal volume--The amount of air delivered for each inhalation.

(2) Respiratory rate--The number of breathes per minute.

(3) Minute volume--The amount of air delivered each minute (tidal volume multiplied by respiratory rate).

(4) Oxygen concentration--Percentage of oxygen mixed with room air.

d. Management of the ventilator and the ventilator patient is normally done by a physician, a respiratory therapist, and specially trained professional nurses. Paraprofessional nursing personnel assigned to patient care areas where ventilator patients are managed will receive special training in the principles of mechanical ventilation.

Section V. PULMONARY DRAINAGE

2-23. THORACENTESIS

a. **General.** Thoracentesis is the procedure in which a puncture is made into the chest wall to withdraw fluid or air from the pleural cavity for diagnostic or therapeutic purposes. A thoracotomy needle is inserted through the intercostal area into the pleural cavity. Suction is then applied by syringe to aspirate the accumulated fluid or air. The procedure is usually done at the patient's bedside.

b. **Assembling the Necessary Equipment.** Assemble the following:

(1) Sterile thoracentesis tray (obtain from CMS).

(2) Calibrated drainage bottle.

(3) Sterile gloves.

(4) 4x4 gauze compresses.

(5) Prescribed local anesthetic.

(6) Alcohol prep sponges.

(7) Adhesive tape.

(8) Mobile table or stand.

(9) Waste receptacle.

c. **Preparation for the Procedure.**

(1) Check clinical record for signed SF 522 (Authorization for Administration of Anesthesia and for Performance of Operations and Other Procedures).

(2) Obtain chest X-rays, if requested.

(3) Explain the procedure to the patient, stressing the importance of remaining immobile during the procedure.

(4) Take and record TPR and blood pressure (BP).

(5) Screen the patient. Remove pajama jacket to expose chest. The site of the puncture will depend upon the location of the fluid or air that is to be aspirated.

(6) Position the patient as directed by the physician. The position may be either one of the following or a similar position, as directed by the physician.

(a) Seat the patient on the side of the bed, facing away from the physician, with feet supported on a chair and the head and arms resting on an overbed table padded with pillows. The arms are elevated slightly to widen the intercostal spaces.

(b) Place the patient in a semi recumbent position, facing away from the physician, resting on the non-affected side, with the head of the bed elevated about 45 degrees. A pillow is placed under the chest to widen the intercostal spaces. The arm of the affected side is placed above the head to elevate the ribs, thereby making the insertion of the needle easier.

d. **Assisting with Thoracentesis.**

(1) Place the thoracentesis tray on instrument table. Open sterile wrapper cover to provide a sterile field.

(2) Place other supplies on adjacent bedside stand or over bed table. Open glove wrapper.

(3) Assist with handling of local anesthetic vial. Hold vial with label uppermost so that the physician can personally check the label before withdrawing any of the solution. Cleanse stopper with alcohol sponge. Invert vial and hold firmly while the doctor, with gloved hands, withdraws the required solution.

(4) Support and help patient to avoid moving and coughing while the thoracentesis needle is introduced.

(5) Assist as directed with collection of specimens as the physician manipulates the syringe, the stopcock, and drainage tubing. Use care not to

contaminate the end of the tubing, the cap, or the open end of the specimen tubes. Cap the tubes and place them upright in a clean glass provided for this purpose. Label each tube as directed by the physician.

(6) If drainage of a large amount of accumulated fluid is necessary, assist the doctor by placing the free end of the tubing in the drainage bottle.

(7) Watch the patient's color; check pulse and respiration. Immediately report any sudden change, as this may indicate damage to the visceral pleura from a nick or puncture by the needle.

(8) After the needle is withdrawn, apply a sterile dressing over the puncture site.

(9) Position patient comfortably (usually Fowler's position).

e. **Follow-up Procedures.**

(1) Remove equipment from bedside to utility room.

(2) Complete entries on appropriate laboratory request forms as directed.

(3) Send properly labeled specimens with completed request forms to laboratory immediately.

(4) Measure and record amount of fluid withdrawn and discard this fluid unless directed otherwise.

(5) Discard disposables, place all linen in hamper, and return appropriate items to CMS.

(6) Continue to observe patient for respiratory difficulty: persistent cough, dyspnea, or the presence of blood in the sputum. Take and record vital signs q4h (every 4 hours), or as ordered.

(7) Obtain post-procedural chest X-rays, if ordered.

(8) Enter the following information on Nursing Notes: date and time, procedure, by whom performed, amount and type of fluid withdrawn, patient's reactions, and specimens sent to laboratory.

2-24. CHEST TUBE INSERTION

a. **General.** Chest tube insertion (tube thoracotomy) is the insertion of one or more flexible tubes into the pleural space to remove air, blood, or fluid. This procedure is done by the physician.

b. **Assembling the Necessary Equipment.** Assemble the following:

(1) Thoracotomy tray (obtain from CMS).

(2) Sterile gloves.

(3) Padded hemostats.

(4) Suture material.

(5) Local anesthetic.

(6) Chest tube and connector.

(7) Chest drainage system: connecting tubing and collection bottles, or commercial system.

(8) Suction apparatus (if ordered).

(9) Mobile table or stand.

c. **Preparation for the Procedure.**

(1) Explain the procedure to the patient.

(2) Obtain and record vital signs.

(3) Assemble the drainage system.

(4) Set up and test the suction apparatus if one is ordered.

(5) Screen the patient and remove pajama coat to expose the chest. The insertion site will depend upon the presence of air or fluid.

(6) Position the patient as directed by the physician.

d. **Assisting with Chest Tube Insertion.**

(1) Set up the thoracotomy tray on the instrument table, using sterile technique.

(2) Using sterile technique, place other supplies on the sterile field.

(3) Assist the physician with the skin prep and administration of local anesthetic as for thoracentesis.

(4) Assist the physician with tube insertion, as directed. There are varying methods of introducing a tube into the pleural space. The method used depends upon the size of the tube to be inserted, the equipment available, and the physician's preference.

(5) The physician connects the patient's chest tube and the drainage tubing, checks the entire system to verify all connections, and tapes the connections to ensure an airtight system. He will then unclamp the chest tube. The clamps are never removed until the drainage system is airtight and ready to function.

(6) The chest tube is normally sutured in place and covered with a sterile dressing.

(7) Arrange for a follow-up chest X-ray, if ordered.

e. **Follow-up Procedures.**

(1) Remove equipment from bedside and care for properly.

(2) Observe patient for respiratory difficulty.

(3) Continue to observe the drainage system for proper function.

(4) Tape the padded hemostats and a package of sterile vaseline gauze to the head of the patient's bed. This equipment must be available for emergency use should the chest tube become dislodged or the drainage system opened.

(5) Record the procedure in the Nursing Notes. Note the patient's tolerance to the procedure.

2-25. WATER-SEAL CHEST DRAINAGE

a. **General.** Underwater-seal chest drainage is a closed (airtight) system for drainage of air and fluid from the chest cavity.

(1) The underwater-seal system is established by connecting a catheter (chest tube) that has been placed in the patient's pleural cavity to drainage tubing that leads to a sealed drainage bottle.

(2) Air and fluid drain into the bottle, but water acts as a seal to keep the air from being drawn back into the pleural space.

(3) By keeping the drainage bottle at floor level, fluid will be prevented from being siphoned back.

(4) As air and fluid are drained, pressure on the lungs is relieved and re-expansion of the lung is facilitated.

b. **Selection of the System.** The physician will specify the drainage setup he prefers to use. It is a nursing responsibility to be familiar with the various systems and their operation.

(1) When the physician specifies his preference, the nursing personnel will obtain, assemble, and check the system, maintaining asepsis within the system.

(2) Chest drainage can be organized into three types of systems. Each can be used with or without suction. Refer to Figure 2-2 as you read the descriptions that follow.

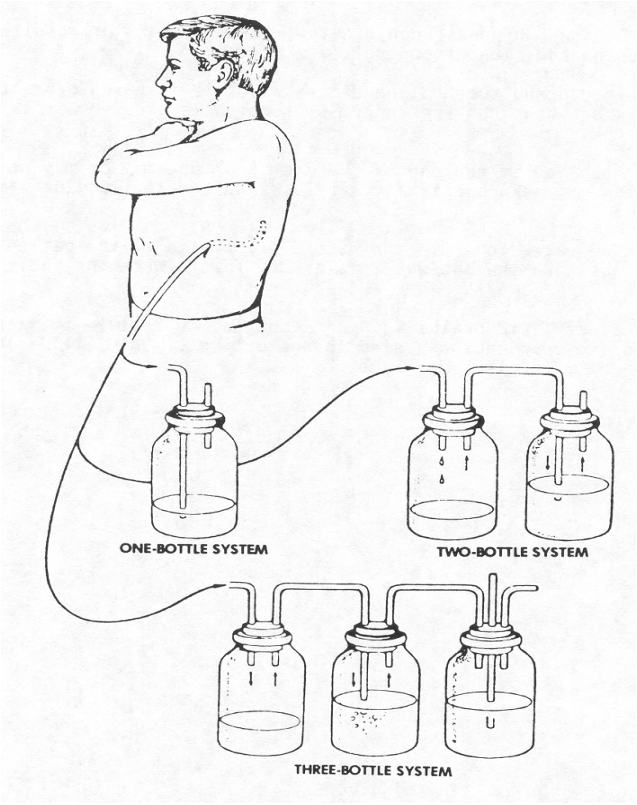


Figure 2-2. Water-seal drainage system

c. **The Single-Bottle Water-Seal System.**

(1) Connecting or drainage tubing joins the patient's chest tube with a drainage tube (glass rod) that enters the drainage bottle.

(2) The end of the glass rod is submerged in water, extending about 2.5 cm (1 inch) below the water level.

(3) The water seal permits drainage of air and fluid from the pleural space but does not allow air to reenter the chest.

(4) Drainage depends upon gravity, the mechanics of respiration, and, if ordered, the addition of controlled suction.

(5) The second tube in the drainage bottle is a vent for the escape of any air drained from the lung. If suction is ordered, it is attached here.

(6) Bubbling at the end of the drainage tube may or may not be visible. Bubbling may mean persistent air leaking from the lung or a leak in the system.

(7) The water level in the bottle fluctuates as the patient breathes. It rises when the patient inhales and lowers when the patient exhales.

(8) Since fluid drains into this bottle, be certain to mark the water level prior to opening the system to the patient. This will allow correct measurement of patient drainage.

d. **The Two-Bottle Water-Seal System.**

(1) The two-bottle system consists of the same water-seal bottle plus a fluid collection bottle.

(2) Pleural fluid accumulates in the collection bottle, and not in the water-seal bottle (as in the single-bottle system).

(3) Drainage depends upon gravity or the amount of suction added to the system.

(4) When suction is added, it is connected at the vent tube in the water-seal bottle.

e. **The Three-Bottle Water-Seal System.**

(1) This system consists of the water-seal bottle, the fluid collection bottle, and a third bottle which controls the amount of suction applied.

(2) The third bottle, called the manometer bottle, has three tubes. One short tube above the water level comes from the water-seal bottle. A second short tube leads to the suction. The third tube extends below the water level and opens to the atmosphere outside the bottle. It is this tube that regulates the suction, depending upon the depth the tube is submerged. It is normally submerged 20 cm (7.6 inches).

(3) The suction pressure causes outside air to be sucked into the system through the tube, creating a constant pressure. Bubbling in the manometer bottle indicates the system is functioning properly.

f. **Commercial Systems.**

There are several disposable commercial drainage systems available. They are plastic devices, divided into chambers for fluid collection, water-seal, and suction control. Follow the manufacturer's instructions for commercial drainage systems used at your facility.

2-26. CARING FOR THE PATIENT WITH WATER-SEAL CHEST DRAINAGE

a. When using suction with water-seal drainage, the system should be open to the atmosphere when the suction is turned off for any reason. This will allow intrapleural air to escape from the system. To do this, simply detach the tubing from the suction port to create an air vent.

b. Observe the water-seal chest drainage system for patency to ensure that it is functioning properly.

(1) Fluid in glass rod (or water seal chamber of commercial devices) should rise and fall with respirations.

(2) Fluctuation should continue until the lung has re-expanded.

c. Observe amount, color, and consistency of chest drainage at ordered time intervals and record results in patient's clinical record.

(1) Notify charge nurse immediately if chest drainage exceeds 100 cc/hour.

(2) Notify charge nurse immediately if chest drainage color changes to indicate an active bleeding problem.

(3) Mark the level of drainage on a piece of adhesive tape affixed to the drainage system every shift, or as ordered; include date, time, and your initials.

(4) Do not empty the drainage system unless directed to do so by the physician.

d. Observe drainage tubing for any kinking.

(1) Do not allow drainage tubing to loop below drainage system entry level.

(2) Fasten the tubing to the draw sheet with rubber bands and safety pins so the flow by gravity will occur.

e. Milk the chest tube, as ordered by the physician, in the direction of chest drainage to promote chest tube patency.

(1) Lubricate the drainage tubing with lubricant (water-soluble) for approximately 12 inches.

(2) Pinch the tubing above the lubrication with one hand; with the other hand compress the tubing, allowing the fingers to slide over the lubrication toward the drainage bottle and release both hands.

f. Observe the patient carefully for any signs of respiratory difficulty, cyanosis, chest pressure, crepitus, and/or hemorrhage.

(1) Monitor vital signs every 4 hours, or as ordered, and record.

(2) Auscultate patient's lung sounds every 4 hours and record findings.

g. Check to see that the drainage bottle is secured to the floor or is in a special holder.

(1) Prevent bottle from being kicked or tipped over.

(2) Caution visitors against handling equipment.

h. Observe the dressing at the chest tube insertion site for air leakage or excessive drainage and record findings.

(1) Dressing changes are performed only according to physician's orders.

(2) Observe skin condition during dressing changes and record.

i. Encourage the patient to cough and deep breath at least every 2 hours or as ordered.

(1) Patient should be assisted to a sitting position if possible to promote effective deep breathing and coughing.

(2) A pillow or blanket should be used to splint the affected area.

j. Encourage the patient to change position every 2 hours to promote drainage and prevent complications; make sure tubing remains free from kinks and is in proper position.

k. Encourage the patient to perform range of motion exercises for the affected upper extremity to maintain joint mobility.

l. Transport or ambulate a patient with a chest tube carefully, keeping the water-seal unit below chest level and upright at all times.

(1) Assist or instruct personnel from other departments in transporting or ambulating the patient.

(2) Nursing staff should accompany the patient.

(3) Disconnect the closed chest drainage system from suction for transportation or ambulation; make sure air vent rod is open.

(4) Attach hemostats (Kelly Clamps) to the patient's hospital gown during transportation or ambulation for emergency use.

m. As indicated, provide emergency care to the patient if the water- seal unit becomes broken or emptied.

(1) Clamp the chest tube unless there has been a large air leak; chest tube with a large air leak should be left open, since clamping may cause a rapid pneumothorax.

(2) Reestablish a closed drainage system.

(3) Remove clamps, if applied.

(4) Notify the professional nurse/physician, as indicated.

(5) Observe the patient for respiratory distress.

n. As indicated, provide emergency care to the patient if the chest tube becomes disconnected from the drainage system.

(1) Clamp the chest tube.

(2) Cleanse the end of the tubing with an antiseptic solution and reconnect or cut off the contaminated tips of the chest tube and tubing and insert a sterile connecting piece.

(3) Securely tape the connection.

(4) Notify the professional nurse/physician, as indicated.

(5) Observe the patient for respiratory distress.

o. As indicated, provide emergency care to the patient if the water- seal unit is tipped over.

(1) Return unit to upright position.

(2) Instruct the patient to deep breathe and cough to force air out of the pleural space.

(3) Notify the professional nurse.

(4) Assess the patient for respiratory distress.

p. As indicated; provide emergency care to the patient whose chest tube has accidentally been pulled out of the chest wall.

(1) Cover the site with sterile 4"x4" gauze sponges and tape occlusively.

(2) Notify the professional nurse/physician immediately.

(3) Monitor the patient for respiratory distress.

q. Record significant nursing observations in the patient's clinical record and report the same to the professional nurse.

(1) Amount, color, and consistency of chest drainage.

(2) Presence or absence of air leaks or bubbling in the water-seal unit.

(3) Presence or absence of fluctuation in the glass rod of the water-seal unit.

(4) Time and results of chest tube milking. Specific observations about the patient, such as vital signs, breathe sounds, and skin color.

(5) Results of deep breathing and coughing.

(6) Position changes or activity, including range of motion.

(7) Condition of chest tube insertion site and dressing.

Section VI. DISORDERS INVOLVING THE UPPER RESPIRATORY SYSTEM

2-27. EPISTAXIS

Nosebleed, called epistaxis, is caused by the rupture of the tiny blood vessels in the nose. Most often, the vessels ruptured are those in the mucous membranes of the nose.

a. Epistaxis may be caused by injury, such as a blow to the nose, "picking" the nose, or forceful blowing of the nose. Nosebleed may also occur as the result of disease or may occur as a symptom of conditions such as sinusitis, bleeding disorders, or hypertension.

b. Epistaxis can often be managed conservatively by compressing the nostril of the affected side against the nasal septum for 5-10 minutes. A cold compress over the nose is also effective in the reduction of both bleeding and swelling. Position the patient with the head forward to allow blood to drain from the nose and not down the throat. Swallowing the blood may lead to nausea and vomiting. Instruct the patient to breathe through the mouth. If the source of the bleeding cannot be seen, the physician may spray the interior of the nose with an epinephrine solution, which will constrict the blood vessels, and pack the interior of the nose with gauze, which will act as a pressure dressing.

2-28. ALLERGIC RHINITIS

Rhinitis is the inflammation of the mucous membrane of the nose. Allergic rhinitis is a general term used to describe any allergic reaction of the nasal mucosa.

a. Non-seasonal (perennial) allergic rhinitis is an allergic rhinitis that may occur intermittently or continuously all year round. It is caused by exposure to an allergen such as house dust, animal dander, or food. It is characterized by sudden attacks of sneezing, swelling of the nasal mucosa with watery discharge, and itching of the eyes with lacrimation.

b. Seasonal allergic rhinitis (hay fever) is a seasonal variety of allergic rhinitis caused by a specific allergen such as a particular pollen. It is characterized by acute conjunctivitis with itching and lacrimation, swelling of the nasal mucosa with watery discharge, sudden attacks of sneezing, and quite often with asthmatic symptoms.

2-29. SINUSITIS

Inflammation of a sinus may be acute or chronic. It usually occurs with other upper respiratory infections since mucous membranes of the nasal cavities are continuous with the sinuses. Sinusitis may also occur from obstructions that block drainage from the sinuses. An untreated acute sinusitis may become chronic or may lead to a more serious condition such as brain abscess, meningitis, or septicemia.

a. Sinusitis is characterized by pain and nasal congestion. The location of the pain is diagnostically important. Frontal pain or headache indicates frontal sinus involvement. Pain in and around the eyes is associated with the ethmoid sinuses. Maxillary sinusitis is characterized by pain lateral to the nose, sometimes accompanied by aching in the upper teeth. In sphenoid sinusitis, an occipital headache may occur.

b. Treatment involves rest and measures to facilitate sinus drainage. Increased humidity, increased fluid intake, and steam inhalation will help to liquify and loosen secretions. Nasal and/or oral use of vasoconstricting drugs is indicated. Antihistimines and antibiotics may also be used depending upon the causative agents involved.

2-30. PHARYNGITIS

Inflammation of the pharynx is caused by several viruses and bacteria. It is characterized by pain in the throat, dysphagia, red and inflamed mucosa, and enlargement of the tonsils and cervical lymph nodes.

a. Throat culture is used to determine the causative organism. If the condition is caused by bacteria such as streptococcus or staphylococcus, the symptoms may be more severe and complications such as sinusitis, mastoiditis, and otitis media may occur.

b. Treatment involves warm saline gargles and irrigations. An ice collar may be used to reduce pain and swelling. Analgesic and antitussive medications are given to alleviate pain and coughing. Antibiotics will be prescribed for a bacterial causative organism.

c. Because of throat discomfort and difficulty swallowing, the patient should be given a soft or liquid diet while symptoms are severe. Fluids should be encouraged.

2-31. TONSILITIS

Tonsilitis is inflammation of the palatine tonsils, a pair of lymphatic tissue structures, and one located on each side of the oropharynx. Enlargement of the adenoids, a large mass of lymphoid tissue at the posterior wall of the nasopharynx, often accompanies acute tonsilitis.

a. Symptoms include a painful and inflamed throat, difficulty swallowing, and enlarged tonsils with exudate that appears as white or yellow spots.

b. Treatment includes warm throat irrigations and analgesics. A throat culture at the tonsillar site is done to determine the type of bacteria present, and antibiotic therapy is initiated.

c. Tonsillectomy and adenoidectomy are indicated when treatment is unsuccessful and antibiotics cannot control frequent recurrent infections or when hypertrophy or peritonsillar abscess threaten to occlude the airway.

2-32. LARYNGITIS

Inflammation of the larynx, or voice box, is most commonly caused by voice abuse, excessive use of tobacco, or as a result of infection.

a. It is characterized by a sore and dry throat, cough, and hoarseness or loss of voice.

b. Treatment involves voice rest and restriction from smoking. Steam inhalation therapy is often indicated. Antibiotic therapy should be initiated if the laryngitis is a result of bacterial infection.

2-33. ACUTE CORYZA

The "common cold" is the term used to refer to afebrile, infectious, acute coryza, which is caused by many different viruses. Colds are highly contagious. Symptoms do not appear until 24-48 hours after exposure to the virus, yet during this time the exposed individual is already contagious.

a. Symptoms may include nasal congestion and discharge, sneezing, sore throat, fever, chills, and malaise. Nasal congestion causes pressure that results in headache. As a cold progresses, a cough may develop. Symptoms last about 1-2 weeks if the infection remains uncomplicated.

b. Treatment is symptomatic, involving the use of analgesics, decongestants, and expectorants. Warm salt-water gargles may relieve sore throat pain. Adequate rest, plenty of fluids, and vitamin C are routinely included in the treatment of a cold.

2-34. CARE FOLLOWING SURGERY OF THE NOSE

a. Surgery of or through the nose may be required to correct the results of trauma to the nose and related structures; to correct deformities that interfere with breathing, such as a deviated septum, hypertrophy of the turbinates, or polyps; and to relieve the effects of sinusitis. Surgery of the nose may also be done for cosmetic reasons.

b. Epistaxis is usually the most serious complication of surgery of the nose. If bleeding occurs postoperatively, attempt to control the bleeding with compression of the nostrils and utilization of cold compresses. If nasal packing is in place, bloody sputum or bloody vomit may be considered signs of nasal bleeding. The nursing personnel must be alert for excessive or continuous bleeding, restlessness, breathing irregularities, cyanosis, and tachycardia. If these signs and symptoms are noted, the professional nurse must be notified immediately. If the physician must be called, make ready a head mirror, light, nasal speculum, packing forceps, and packing material.

c. Quite often, the patient's nose will be packed at the termination of the surgery. This may cause an intense fear of suffocation. The patient must be reassured that mouth breathing will supply sufficient air. Continued mouth breathing will cause dryness of the lips and mouth. Ointment such as petrolatum should be applied to the patient's lips and fluids given as tolerated to moisten the mouth. The patient may have the urge to blow his nose to relieve the sense of fullness caused by the packing. Instruct the patient not to blow his nose, as this may cause bleeding and would be ineffective in relieving the sense of fullness.

2-35. TONSILLECTOMY AND ADENOIDECTOMY

a. Removal of the tonsils and adenoids is indicated in cases of recurrent infections or in cases of swelling that threatens to obstruct the airway.

b. Postoperative nursing management involves maintenance of a patent airway and observation for bleeding and aspiration.

(1) If the operation was done under a local anesthetic, place the patient in a sitting position to maintain airway patency.

(2) If the operation was done under general anesthesia, place the patient in a lateral recumbent position with the head extended. This will allow drainage through the nose and mouth.

(3) Observe vital signs closely and be alert for changes that may indicate bleeding, such as gurgling respirations or excessive swallowing.

(4) Keep the patient as quiet as possible.

(5) Place an ice collar around the neck to constrict blood vessels and reduce pain.

c. An unconscious or bleeding patient should never be left alone. Suction equipment should be available for use. If suctioning is necessary, it should be done carefully and gently to avoid disturbing the operative sites.

d. Encourage the patient to take the diet prescribed by the physician. For the first few days the diet will probably be liquid or semisolid. All foods and fluids should be bland, avoiding citrus, acidic foods, and spices. Diet should be advanced as patient tolerance dictates.

e. Utilize prescribed analgesics, since the throat will be sore for several days postoperatively.

2-36. LARYNGECTOMY

a. Surgery of the larynx is done most often to remove a tumor or growth that may be malignant.

(1) A malignant growth may occur on the vocal cords (intrinsic) or on another part of the larynx (extrinsic). The type of surgery done depends upon the location and involvement of the growth.

(2) Newly developed surgical procedures are being used in the management of laryngeal growths. Some procedures involve resection of the larynx or formation of an air passage from the trachea to the pharynx. The objective of these procedures is to preserve the voice.

b. Partial laryngectomy is the removal of that portion of the vocal cord that is involved with abnormal growth. A tracheostomy tube may be left in the neck wound for a few days postoperatively. The neck wound will eventually heal, and the normal respiratory system and voice are preserved.

c. Total laryngectomy is the removal of the larynx, vocal cords, thyroid cartilage, and the epiglottis. The trachea is sutured to the anterior surface of the neck as a permanent tracheostomy. The patient breathes exclusively through the neck opening

(stoma) and is referred to as a total neck breather, since the airway between the mouth, nose, and throat has been completely closed.

(1) Total laryngectomy with laryngoplasty involves the formation of a tube that leads from the upper trachea to the lower pharynx. This "speaking" tube allows for speech that sounds almost normal. A patient having this type of laryngectomy is referred to as a partial neck breather, since the tube allows the passage of air from the nose and mouth into the trachea.

(2) When the patient has a total laryngectomy, the surgeon will most likely place a laryngectomy tube in the newly formed stoma. This tube may be removed when the stoma has healed, usually within 4-6 weeks. The laryngectomy tube is shorter, but larger in diameter, than a tracheostomy tube. Care of the laryngectomy tube is the same as that for the tracheostomy tube.

(3) Since the patient will not be able to speak initially, some means of communication must be developed for the patient. Commonly used techniques are simple note writing, flash cards, magnetic letter boards, and magic slates. Always have a call bell within the patient's reach. When the stoma has healed, the speech pathologists will work with the patient to help him learn new speaking methods.

d. Special considerations for the laryngectomee include the following:

(1) For the laryngectomee, air passes directly into the trachea without being moistened and warmed by the upper respiratory mucosa. This causes the trachea and bronchi to secrete excessive amounts of mucous, and the patient may experience frequent bouts of coughing. In time, the mucosa of the trachea and bronchi will adapt to this altered physiology. In the meantime, however, the patient will be more comfortable with added humidification in the inspired air. This may be provided by steam or cool mist humidifiers.

(2) Precautions must be taken in the shower to prevent water from entering the stoma. A small plastic bib worn around the neck works well. Swimming is not recommended, as the laryngectomee may drown without ever putting his face in the water.

(3) Care must be taken to prevent hair spray, powder, loose hairs, and any other foreign objects from entering the stoma.

(4) A laryngectomee should carry or wear identification that will alert a first-aid giver to his special resuscitation needs. A laryngectomy stoma may be hidden by a scarf and not noticed by the first-aid giver. A neck breather, whether partial or total, requires artificial ventilation through the stoma. This may be done by mouth-to-stoma artificial respiration or by bag-mask to stoma. If the patient wears a tube in his stoma, do not remove it. Give artificial ventilation through it. The mouth and nose must be sealed closed to prevent the escape of air from the nose and mouth, in the event that the patient is a partial neck breather.

2-37. TRACHEOSTOMY

a. A tracheotomy is the incision of the trachea through the skin and muscles of the neck. When an indwelling tube is inserted into the surgically created opening in the trachea, the term “tracheostomy” is used. A tracheostomy may be permanent or temporary. There are many diseases and conditions that make a tracheostomy necessary. For example, a tracheostomy may be done:

(1) To bypass an upper airway obstruction.

(2) To replace an endotracheal tube with a tracheostomy tube.

(3) To allow for extended mechanical ventilation.

(4) To facilitate removal of tracheobronchial secretions.

(5) To prevent aspiration in the comatose or paralyzed patient.

b. A tracheostomy tube (sometimes referred to as a tracheal cannula set) consists of three parts: the outer cannula, the inner cannula, and the obturator. Refer to Figure 2-3.

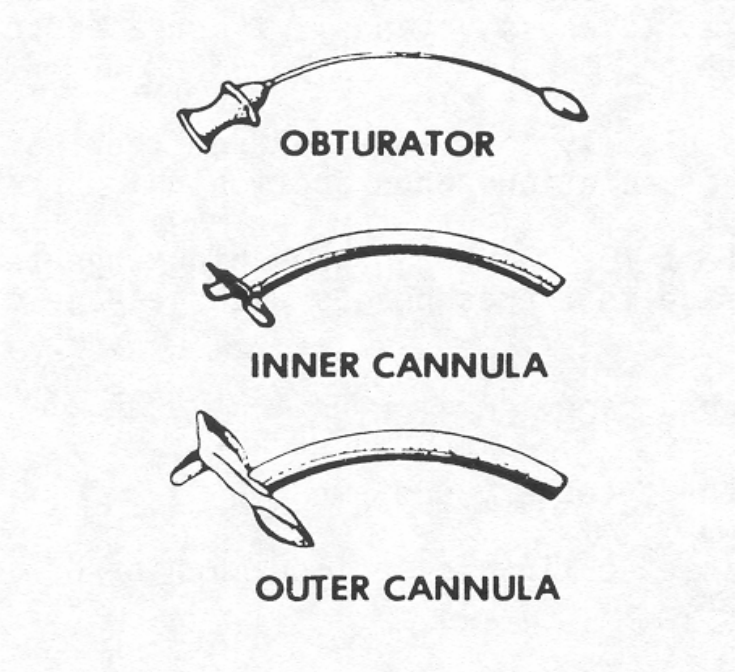


Figure 2-3. Tracheostomy tube set

(1) The obturator is used by the surgeon as a guide when inserting the outer cannula into the tracheal incision.

(2) After insertion of the outer cannula, the obturator is removed. The inner cannula is inserted into the outer cannula and locked in place.

(3) Tracheostomy tubes may be metal or plastic. Plastic tubes that have an inflatable cuff surrounding the outer cannula are the most commonly used. The cuff helps to hold the tube in place, prevents aspiration of material into the lungs, and prevents leaking of air around the sides of the tube.

(4) The tracheostomy tube is kept in place by means of cotton twill tape inserted through the slotted flanges of the outer cannula and tied around the patient's neck. A sterile dressing is placed around the tube to protect the stoma.

2-38. TRACHEOSTOMY NURSING CARE

a. **Preparatory Nursing Measures.** In addition to routine preparation of the patient unit for postoperative care, the following measures should be planned in advance.

(1) The patient will require constant attendance for at least the first 48 hours. The nursing personnel must remember two important things: the patient's life depends upon a clear airway, and the patient will have a temporary loss of voice. Therefore, the patient must be observed closely for airway patency and immediate action taken when any adverse signs or symptoms are present. The patient will feel anxious about his inability to communicate with his voice. Always have the call bell available to the patient. Devise a temporary means of communication such as writing notes or using flash cards so that the patient may communicate his needs to the nursing personnel.

(2) For the first few days postoperatively, the patient should be kept in a room where the temperature and humidity can be maintained at optimum levels. Increased temperature and humidity will help to reduce the tracheal irritation that results when inspired air has bypassed the natural warming and moisturizing of the nasopharyngeal airway.

(3) The patient's room should be supplied with a variety of equipment necessary to the care of the patient. Such things include suction equipment, a spare tracheostomy tube set, and sterile dressing material.

b. **Postoperative Nursing Measures.** In addition to routine postoperative nursing care, the following nursing actions should be noted.

(1) Always apply basic principles of aseptic technique when caring for the incision and the airway. When suctioning, use separate set-ups for pharyngeal and tracheostomy suctioning.

(2) Constantly observe the patient for signs of respiratory obstruction such as restlessness, cyanosis, increased pulse, or gurgling noises during respiration.

(3) Watch closely for bleeding from the incision, and look for blood in the aspirated secretions when suctioning.

(4) Be alert for choking or coughing when the patient swallows. This may indicate damage to the esophagus with leakage of swallowed material into the trachea.

2-39. PERFORMING TRACHEOSTOMY SUCTIONING

a. Assemble the necessary equipment.

(1) Portable continuous suction machine or in-wall suction.

(2) Sterile suction kit containing sterile suction catheters (14-18ºFr.), a sterile solution container, and sterile gloves.

(3) Sterile saline in a pour bottle.

(4) Sterile gauze sponges.

(5) Sterile normal saline in 5cc packets for tracheal instillation, if ordered.

(6) Oxygen source with flow meter and a manual resuscitator (ambu bag).

(7) Waste receptacle.

b. Explain the suctioning procedure to the patient if he is conscious.

(1) Hyper oxygenation will be performed. An ambu bag with 100 percent oxygen will be connected to the tracheostomy tube and the patient will be given several breaths prior to suctioning. This is done to prevent shortness of breath or hypoxia.

(2) Approximately 5cc of normal saline will be instilled into the tracheostomy tube to help liquify secretions. Inform the patient that this may stimulate a cough reflex.

c. Place the patient in semi-Fowler's position if permitted.

d. Wash your hands and set up the sterile suction kit.

(1) Open the suction kit, using the wrapper to create a sterile field. Place the sterile sponges on the field.

(2) Pour 50-100cc of sterile saline into the solution container, using a septic technique.

e. Turn on the suction unit and set to low pressure to avoid trauma to the patient.

f. Using aseptic technique, don the sterile gloves.

g. Attach the sterile suction catheter to the connecting tubing by holding the catheter in your dominant hand (sterile hand) and the connecting tube in your non-dominant hand (non-sterile hand). Refer to Figure 2-4.

h. Moisten the catheter tip in the sterile saline.

i. Instruct your assistant to hyper oxygenate the patient.

(1) Disconnect ventilator tubing if patient is receiving mechanical ventilation.

(2) Give the patient several breaths of 100 percent oxygen with the ambu bag and quickly remove the bag.

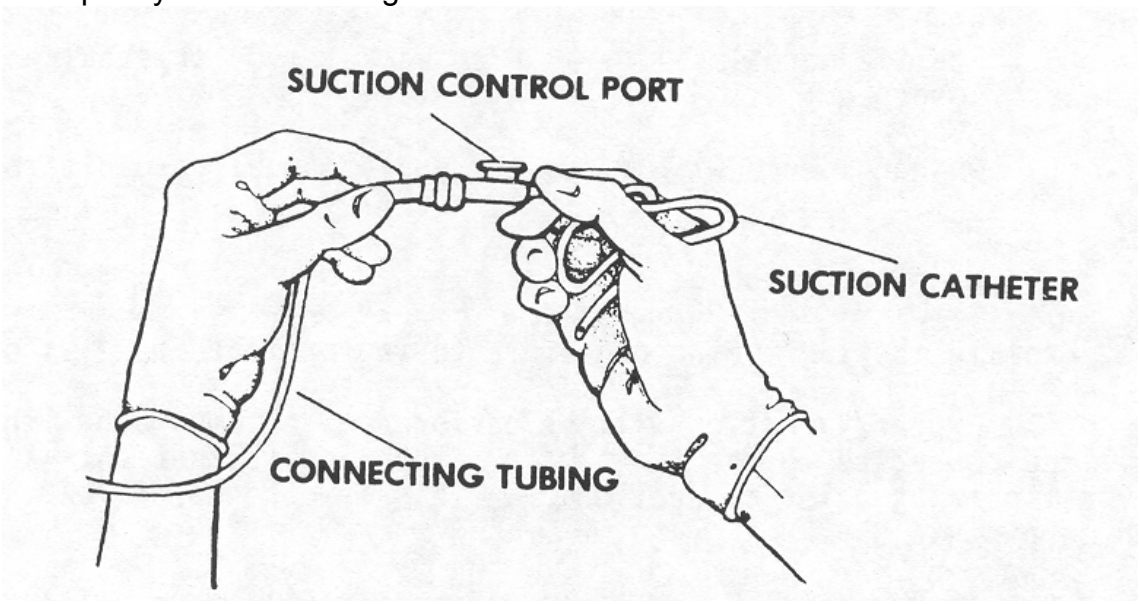


Figure 2-4. Suction catheter and connecting tube.

j. With the suction diverted, gently insert the sterile suction catheter into the tracheostomy tube until slight resistance is felt, then pull back slightly.

k. Apply suction.

(1) Place the thumb of your non-dominant (non-sterile) hand over the suction control port of the catheter.

(2) Rotate the catheter between the thumb and index finger of your sterile hand while withdrawing the catheter. Apply intermittent suction while withdrawing.

(3) Suction only for 5-10 seconds. Refer to Figure 2-5.

l. Instruct the assistant to hyper oxygenate the patient while you rinse the catheter by suctioning a small amount of the sterile saline.

m. If secretions are thick, instill 5 cc of sterile normal saline into the tracheostomy tube and suction again.

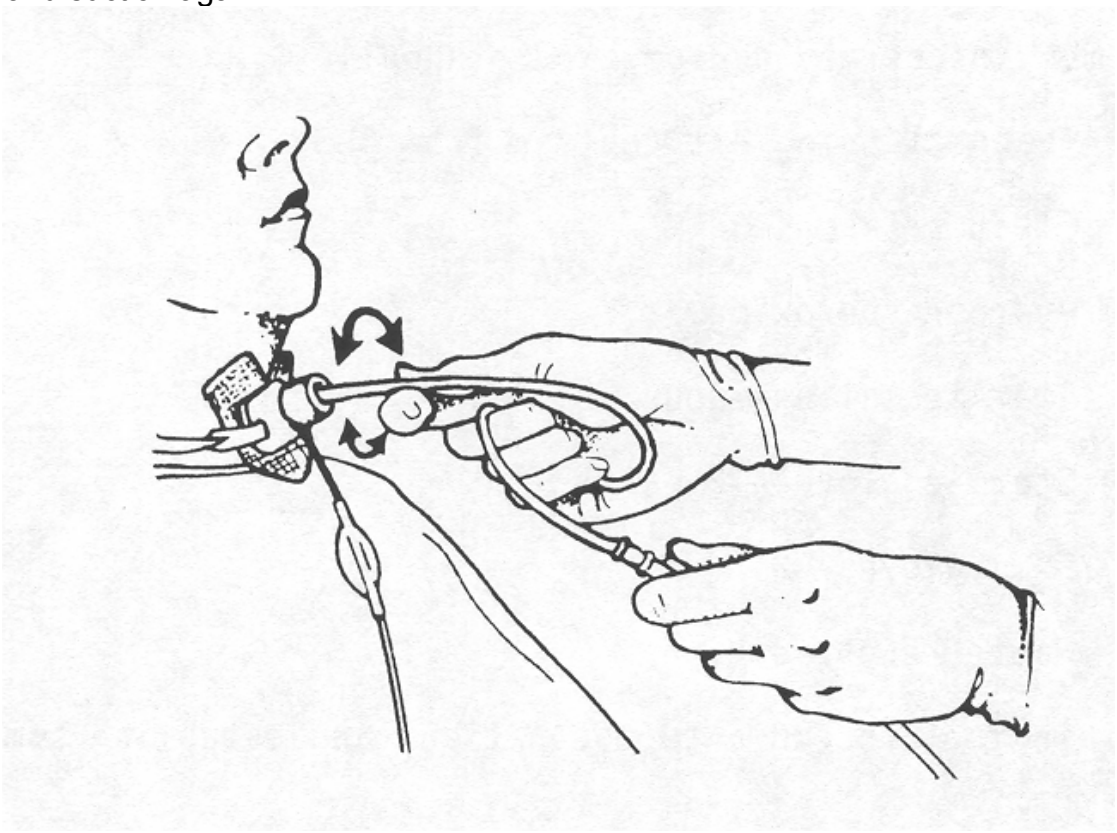


Figure 2-5. Tracheostomy suctioning.

n. Repeat the suction procedure until the airway is clear.

(1) Hyper oxygenate the patient between suctioning.

(2) Rinse the catheter between suctioning.

o. Reconnect the patient to the ventilator if one is in use.

p. Perform oropharyngeal suctioning, if required.

q. Discard used equipment and restock the patient's bedside with new equipment.

r. Record the procedure in the Nursing Notes.

2-40. PERFORMING TRACHEOSTOMY CARE

Changing the tracheostomy dressing, cleansing the skin around the stoma, and cleaning the inner cannula are collectively referred to as tracheostomy care.

a. Assemble necessary equipment and supplies.

(1) Trach cleaning kit (obtain from CMS).

(2) Clean scissors.

(3) Hydrogen peroxide.

(4) Sterile saline--pour bottle.

(5) Sterile gloves--2 pairs.

(6) Exam gloves--2.

(7) Waste receptacle.

b. Explain the procedure to the patient and establish a method of communication.

c. If suctioning is required, perform that procedure prior to beginning tracheostomy care. It is routine to perform tracheostomy care after suctioning.

d. Position the patient in semi-Fowler's position if permissible.

e. Wash your hands and set up the equipment using aseptic technique.

(1) Open the cleaning kit, using wrapper as a sterile field.

(2) Open dressings and other supplies and place on sterile field.

(3) Pour hydrogen peroxide in one basin and sterile saline in the other (disposable basins/containers are included in the kit).

f. Put on exam gloves and remove soiled tracheostomy dressing. Tracheostomy secretions should be considered contaminated and handled accordingly.

g. Remove and discard exam gloves and put on sterile gloves.

h. Clean inner cannula, if present.

(1) Unlock the inner cannula and remove.

(2) Place the inner cannula in the hydrogen peroxide, allowing it to soak for a few minutes.

(3) Clean the inner cannula with the test tube brush.

(4) Rinse the inner cannula in the sterile saline.

(5) Remove the inner cannula from the saline and allow it to drain on a sterile 4x4 gauze sponge.

i. Cleanse the tracheostomy incision and surrounding area with antiseptic swabs.

(1) If crusting occurs, remove with sterile swabs soaked in hydrogen peroxide.

(2) Do not allow cleansing solutions to enter the tracheostomy opening.

j. Reinsert the inner cannula and lock in place.

k. Apply sterile tracheostomy dressing. Use precut, non-raveling sterile 4x4. Place it with the slit toward the chin, allowing the uncut portion to absorb secretions.

l. Reapply ties.

(1) Cut and remove soiled, outer tube ties if necessary. The patient or an assistant should hold the outer tube in place to prevent dislodgement of the tube.

NOTE: If an assistant is not available and the ties must be changed, secure new ties in place before cutting and removing soiled ties.

(2) Cut a slit about one inch from the end of each tape.

(3) Insert the slit end of the tape through the flange of the outer cannula, and draw the other end of the tape through the slit (Figure 2-6).

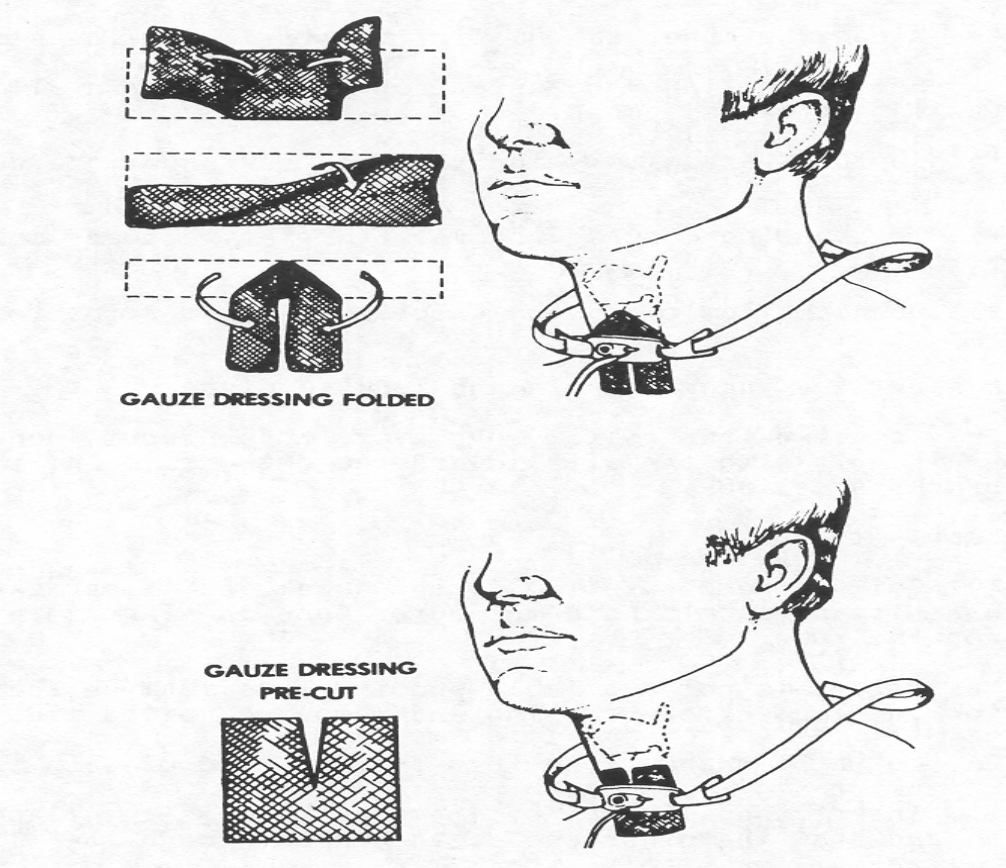


Figure 2-6. Tracheostomy dressing.

(4) Tie the tapes securely with a knot, never a bow. Position the knot at the side of the patient's neck rather than the back. Trim off excess tape.

m. Remove and discard gloves or return all equipment to the appropriate location.

n. Record procedure in Nursing Notes.

Section VII. DISORDERS INVOLVING THE LOWER RESPIRATORY SYSTEM

2-41. PLEURISY

a. Inflammation of the visceral and parietal pleura is called pleurisy. When the inflamed membranes rub together during respiration, it causes a severe, sharp pain. During the dry stage, a pleural friction rub can be heard on auscultation. Later, fluid develops between the inflamed pleura and the pain lessens.

b. This inflammation may occur after chest trauma or thoracotomy, may be associated with cancer, or may accompany upper respiratory infections, pneumonia, or tuberculosis.

c. The physician must discover the underlying cause of the inflammation and treat it. Along with the treatment of the primary cause, symptomatic treatment should be utilized for the effects of the pleurisy. Applications of heat or cold may ease discomfort. Analgesics should be used to decrease the pain. Anti-inflammatory drugs are also useful in decreasing the painful inflammation of the pleura. Additionally, the patient should be closely observed for signs indicating the development of pleural effusion.

2-42. PLEURAL EFFUSION

a. Pleural effusion is the collection of fluid in the pleural space. Normally, the pleural space contains a small amount of lubricating fluid that allows the surfaces of the visceral and parietal pleura to move without friction. When pleural effusion is present, the patient will experience shortness of breath and rapid pulse. Decreased breath sounds will be noted on auscultation of the affected lung.

(1) Pleural effusion is normally secondary to other disease processes. When factors influencing formation and re-absorption of pleural fluid are altered, a transudate occurs. A transudate is fluid with a relatively low content of protein, cells, and cellular debris. The presence of transudate would indicate an underlying cause such as congestive heart failure, renal failure, or ascites.

(2) Local inflammation within the pleura, in adjacent tissues, or beneath the diaphragm will cause an exudate. An exudate is fluid characterized by a relatively high content of protein, cells, and cellular debris. The presence of exudate is indicative of tuberculosis, pneumonia, pulmonary viruses, or cancer.

b. Again, the physician must identify and treat the underlying cause in order for the effusion to resolve. Large amounts of fluid should be removed in order to relieve the dyspnea and discomfort felt by the patient. This can be done by needle aspiration (thoracentesis) or by the insertion of chest tubes to drainage. Analgesics should be used to reduce discomfort.

2-43. ATELECTASIS

a. Atelectasis is defined as collapse of the lung. This means the collapse of an alveolus or multiple alveoli. There are two different mechanisms that may cause alveolar collapse.

(1) Pressure on the lung that restricts normal lung expansion of the alveoli. Whenever there is an overcrowding of the thoracic contents, the spongy lung tissue will be the first thing to collapse as a result of the compression. Such pressure may be caused by pleural effusion, pneumothorax, tumor growth, or an upwardly displaced diaphragm.

(2) Obstruction of a bronchus may restrict airflow to and from the communicating alveoli. This may be caused by inhalation of a foreign body, but the

most frequent cause is the presence of thick mucous that is not removed by coughing. Postoperative patients and debilitated bedridden patients are susceptible to obstructive atelectasis due to inadequate depth of respiration and the accumulation of bronchial secretions.

b. If a sudden collapse involving sufficient tissue occurs, the following signs and symptoms may be present: dyspnea, tachycardia, anxiety, cyanosis, and pleural pain. The chest wall of the affected side will barely move on respiration.

c. Treatment involves the identification and correction of the underlying cause. If the presence of air or fluid in the pleural space is causing compression, measures should be taken to remove the air or fluid by thoracentesis or chest tube insertion. Bronchial obstruction should be removed by the use of vigorous percussion, coughing, and postural drainage. Secretions may be loosened and liquefied by the use of humidification and increased fluid intake.

d. Postoperative atelectasis can be reduced significantly by the use of early ambulation, incentive spirometery, and a rigorously enforced program of deep breathing and coughing.

2-44. CHRONIC OBSTRUCTIVE PULMONARY DISEASE.

a. Chronic obstructive pulmonary disease (COPD) is a broad term used to classify conditions associated with chronic obstruction of the airflow entering or leaving the lungs. Chronic obstructive pulmonary disease is characterized by increased resistance to airflow due to one of the following basic conditions:

(1) Excessive secretion of mucous within the airways that is not because of a specific cause (such as an underlying infection) will obstruct airflow. This is typical of chronic bronchitis.

(2) An increase in the size of the alveoli with a loss of elasticity will increase airflow resistance. This is the case in emphysema.

(3) Narrowing of the bronchial airways significantly restricts airflow. This type of obstruction is characteristic of asthma.

b. There are other similar conditions that may be classified as COPD. In all these conditions, the underlying problem is the same. Altered physiology of the respiratory structures has caused a chronic airflow problem due to obstruction of part of the air passageways.

c. Physical examination and patient history will usually identify the altered physiology at work. Treatment is based upon symptomatic relief, use of controlled oxygen therapy, and medications to compensate for the altered physiology. Patient education is important, since there is no cure for these conditions. They are the result of years of progressive deterioration of normal physiology.

2-45. PNEUMONIA

a. Pneumonia is inflammation of the lungs accompanied by consolidation (lung becomes firm as air spaces are filled with exudate). This condition is most commonly caused by infectious agents such as viruses, bacteria, or fungi. Inhalation of caustic gases may cause chemical pneumonia.

b. Pneumonia may be referred to as lobar pneumonia if the majority of a lobe is involved. The term bronchopneumonia is used when the inflammation begins in the bronchi and extends to adjacent lung tissue.

c. Signs and symptoms include fever, chills, chest pain, rapid and difficult breathing, and rapid pulse accompanied by a painful cough and purulent sputum. The organisms are spread by droplets or by contact with material contaminated with respiratory secretions.

d. Treatment depends upon the causative agent. Antibiotic therapy is initiated when the agent has been identified. Increased fluid intake and humidification are encouraged to liquefy secretions and aid in their expectoration. Percussion and postural drainage are also used to loosen and mobilize secretions. Pain medications should be used to relieve the pleuritic pain, but care should be taken to avoid suppressing the cough reflex.

2-46. PULMONARY EMBOLISM

a. Pulmonary embolism is the presence of one or more thrombin that has moved from their site of origin, into the pulmonary vascular bed, to obstruct one or more of the pulmonary arteries. These thrombin originate somewhere in the venous system or the right side of the heart. They become dislodged and are carried to the lung, interrupting the blood supply to lung tissue and causing infarction of lung tissue.

b. Signs and symptoms range from nonexistant to pleuritic pain, cough, hemoptysis, tachycardia, dyspnea, and anxiety. The symptoms present will depend upon the size of the thrombus and the location of the occlusion.

c. Treatment for pulmonary embolism involves immediate measures to stabilize the patient. Massive pulmonary embolism is a life threatening medical emergency. Oxygen is administered to relieve respiratory distress. An IV is started to provide a life-line for administration of emergency medications. If the embolism is severe enough, the patient may require an indwelling urinary catheter, endotracheal intubation, mechanical ventilation, and ECG monitoring. The second aspect of treatment involves anticoagulant therapy to prevent recurrence or extension of the embolism. This therapy is potentially dangerous and must be strictly controlled by the physician.

2-47. PULMONARY EDEMA

a. Pulmonary edema is an abnormal accumulation of fluid in the lungs. The most common cause of pulmonary edema is cardiac disease. When the pulmonary blood vessels receive more blood from the right heart than the left heart is able to receive in return, pulmonary congestion occurs. Pulmonary edema is the end result of unrelieved pulmonary congestion. The congested pulmonary capillaries leak fluid into the nearby air spaces. As the pulmonary edema progresses, the escaping fluid mixes with alveolar air and a frothy sputum is produced, churning and gurgling with each respiration. This causes the characteristic "death rattle" associated with severe pulmonary edema. Fluid build-up in the lungs prevents air from entering the alveoli, causing severe hypoxia.

b. Treatment involves measures to improve ventilation and oxygenation and reduce lung congestion. The patient should be positioned in an upright position to decrease venous return to the right heart, thereby decreasing the right ventricular output to the lungs. Oxygen is used to relieve dyspnea and hypoxia. Administration of morphine in small doses will decrease the anxiety and dyspnea. Diuretics are used to decrease the fluid volume if necessary. Since pulmonary edema is a result of an imbalance between the left and right heart, treatment will also include those therapies and medications necessary to stabilize the heart dysfunction.

2-48. PNEUMOTHORAX AND HEMOTHORAX

a. Pneumothorax is defined as the presence of air in the pleural space.

(1) This condition may occur after thoracentesis or pleural biopsy.

(2) It may also occur secondary to mechanical ventilation when use of excessive pressures results in tissue rupture. When there is a rupture of lung tissue (alveoli or visceral pleura), a "spontaneous" pneumothorax is said to have occurred.

(3) Chest trauma, such as a puncture or missile wound, allows air to enter the pleural space, also causing pneumothorax.

b. When air enters the pleural space through a hole in the lungs, the tissue around the edges of the hole acts as a valve, allowing air to enter the pleural space, but not to escape. This condition is called a tension pneumothorax because there is a build up of pressure (tension) within the pleural space. This pressure, if unrelieved, will cause lung compression and eventual collapse. Additionally, the mediastinum may be displaced, causing disrupted circulation.

(1) Tension pneumothorax may occur when there is a wound in the lung that does communicate with the exterior of the body. For example, a fractured rib may be pushed inward, tearing the lung and the surrounding pleura. Air can now escape from the lung, but is trapped in the pleural space.

(2) Tension pneumothorax may also occur when a sucking chest wound has been sealed with an occlusive dressing. The air will escape from the lung into the pleural space with each inspiration, but will be trapped due to the occlusive dressing over the exterior wound.

(3) Tension pneumothorax may also occur as a postoperative complication. The opening at fault may be leakage around the drainage tube, an undiscovered opening in the visceral pleura, or faulty suturing of resected lung tissue.

c. Hemothorax is the accumulation of blood in the pleural cavity. This condition usually accompanies chest trauma. Blood from lacerated lung tissue and torn blood vessels enters the pleural cavity and pools in the dependent area.

d. When air and blood are found in the chest cavity together, the condition is called hemopneumothorax.

e. Treatment for all the above conditions involves the removal of the air or blood from the pleural cavity, thereby allowing the lung to expand once again. This is routinely done by thoracentesis for small amounts of air or blood or by the insertion of chest tubes to drainage when a large amount of air or blood is involved. Other treatment measures involve administration of oxygen and analgesics.

2-49. THORACIC SURGERY

a. Pulmonary resection is removal of a significant portion of a lung. Resection in which a lobe of a lung is removed is referred to as lobectomy. Removal of the entire lung is referred to as pneumonectomy. These procedures are done to treat diseases such as tuberculosis and cancer or to deal with the consequences of trauma to the lungs.

b. These procedures involve opening the pleural cavity containing the affected lung. When the pleural cavity is opened, the affected lung will collapse. After completion of the desired surgical procedure, the surgeon will place a tube into the pleural cavity. The use of either an air-tight underwater seal or suction on the tube will help recreate the naturally existing partial vacuum in the pleural cavity and re-expand the remainder of the affected lung. The tube is withdrawn when the air and fluid has been removed from the pleural cavity.

c. In addition to the routine preoperative care given to any surgical patient, patients scheduled for thoracic surgery require special nursing considerations.

(1) Frequently, much time must be devoted to improving the patient's respiratory status prior to surgery. This will make the preoperative period longer than normal.

(2) The patient will be instructed in special exercises that will strengthen those muscles of the shoulders and chest that support respiratory movement. These exercises are routinely taught by the physical therapist. The nursing personnel, however, must be familiar with these exercises. It is a nursing responsibility to reinforce the teaching, observe, and assist the patient in correct procedure.

(3) Preoperative patient education must include preparing the patient and his family, the postoperative course of events, to include chest tubes, suctioning, and artificial ventilation, as appropriate.

(4) Preoperative education can be used to reduce the potential for complications. (For example, teaching the importance of active range of motion of the arms may prevent the patient from developing a "frozen" shoulder.) Always explain what must be done and why it is important. A patient will naturally be reluctant to perform a movement or exercise that is painful to him.

d. In addition to general postoperative nursing care, the following considerations for chest surgery patients must be noted.

(1) Intake and output must be strictly monitored.

(2) Intravenous fluids are routinely given slowly and in limited amounts (as ordered by the physician) to avoid fluid overload and pulmonary edema.

(3) Vigorous turning, coughing, and deep breathing must be done to expel secretions. If these secretions are not removed, atelectasis may occur. Secretions that cannot be removed by coughing must be removed by suctioning.

(4) Blood pressure, pulse, and respirations should be taken and recorded frequently for the first 24 hours postoperatively. Nursing personnel should note general appearance, skin color and temperature, character of respiration, and appearance of the wound site. Close observation must be made for signs of shock, hemorrhage, pulmonary edema, or respiratory embarrassment.

(5) Early ambulation of chest surgery patients is desired, with exercises as prescribed, to promote lung reinflation, good body posture, and maintenance of shoulder movement and muscle tone. Increase in ambulation will depend upon physician's orders, nursing assessment, and the patient's desire for independence.

(6) Proper positioning while bed resting is extremely important. The pneumonectomy patient should not be placed directly on his inoperative side. To do so will place additional strain on the already overtaxed remaining lung. Patients undergoing resection should not be placed on the operative side, as this interferes with the desired maximum expansion of the operative lung.

2-50. CONCLUSION

a. This lesson has introduced the basic nursing care techniques and procedures involved in the nursing care related to the respiratory system.

b. Review the lesson objectives once again. If you feel confident that you have achieved the lesson objectives, complete the exercises at the end of this lesson.

c. If you do not feel that you have met the lesson objectives, review the necessary material before you attempt the end of lesson exercises.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by completing the incomplete statement or by writing the answer in the space provided at the end of the question.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. The upper respiratory system is composed of the _____, _____ ,and _____ .

2. The bronchioles terminate in the _____.

3. The organ of respiration is the _____.

4. The layer of serous membrane that lines the chest cavity is called the _____ pleura.

5. The exchange of oxygen and carbon dioxide in the lungs is called _____.

6. The respiratory center is located in what part of the brain? _____.

7. The exchange of gases between the capillary blood and the body cells is called _____.

8. Air flows from an area of _____ to an area of _____.

9. When observing a patient's respirations, you should note the _____, _____, and _____.

10. The procedure used to mobilize secretions and aid in lung expansion is called _____.

11. Before and after percussion you should _____.

12. An incentive spirometer is a device that stimulates the patient to _____.

13. A device that delivers precise, controlled concentrations of O_2 by mixing O_2 with room air is a _____.

14. Suctioning the trachea interferes with _____.

15. A positive pressure breathing device which maintains respirations is called a(n) _____

16. The purpose of thoracentesis is to _____ _____.

17. What should <u>always</u> be kept in the immediate area of a patient with a chest tube? _____ or _____.

18. When water-seal drainage is used without suction, drainage depends upon _____ and _____.

19. When using suction with water-seal drainage, if the suction is turned off for any reason, you must _____.

20. When managing epistaxis, you should position the patient with the head _____.

21. Inflammation of the mucous membrane of the nose is called _____.

22. When giving artificial ventilation through a laryngectomy stoma, you must _____ _____ if the patient is a partial neck breather.

23. List the three parts of a tracheostomy cannula set. _____, _____, _____.

24. Immediately prior to suctioning a tracheostomy, you should _____ _____ to prevent shortness of breath.

25. Inflammation of the visceral and parietal pleura is called _____.

26. Collection of fluid in the pleural space is called _____.

27. Collapse of the alveoli is called _____.

28. _____ is the end result of unrelieved pulmonary congestion.

29. _____ is a substance secreted by some alveolar cells.

30. The most common cause of pulmonary edema is _____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. Nose, pharynx, larynx, and trachea. (para 2-2b)
2. Alveoli (or final air spaces). (para 2-3e)
3. Lung. (para 2-3f)
4. Parietal. (para 2-3f)
5. External respiration. (para 2-4a)
6. Medulla. (para 2-5a)
7. Internal respiration. (para 2-4b)
8. Higher pressure; lower pressure. (para 2-5b)
9. Rate, rhythm, depth. (para 2-8b)
10. Percussion. (para 2-14)
11. Auscultate the patient's lungs. (paras 2-10d, 2-16)
12. Achieve maximum voluntary lung expansion. (para 2-17)
13. Venturi mask. para 2-18d)
14. Oxygenation. (para 2-20a)
15. Mechanical ventilator. (para 2-22)
16. Withdraw fluid or air from the pleural cavity. (para 2-23a)
17. Hemostats or clamps. (para 2-24e)
18. Gravity; the mechanics of respiration. (para 2-25c(4))
19. Open the system to the atmosphere (create an air vent). (para 2-26a)
20. Forward. (para 2-27b)
21. Rhinitis (para 2-28)
22. Seal both the mouth and nose closed. (para 2-36d(4))

23. Inner cannula, outer cannula, obturator. (para 2-37b)

24. Hyper oxygenate the patient. (para 2-39b)

25. Pleurisy. (para 2-41)

26. Pleural effusion. (para 2-43)

27. Atelectasis. (para 2-43)

28. Pulmonary edema. (para 2-47)

29. Surfactant (para 2-3f)

30. Cardiac disease. (para 2-47)

END OF LESSON 2

COMMENT SHEET

SUBCOURSE MD0917, Nursing Care Related to the Cardiovascula r and Respiratory System EDITION 100

Your comments about this subcourse are valuable and aid the writers in refining the subcourse and making it more usable. Please enter your comments in the space provided. ENCLOSE THIS FORM (OR A COPY) WITH YOUR ANSWER SHEET **ONLY** IF YOU HAVE COMMENTS ABOUT THIS SUBCOURSE..

FOR A WRITTEN REPLY, WRITE A SEPARATE LETTER AND INCLUDE SOCIAL SECURITY NUMBER, RETURN ADDRESS (and e-mail address, if possible), SUBCOURSE NUMBER AND EDITION, AND PARAGRAPH/EXERCISE/EXAMINATION ITEM NUMBER.

PLEASE COMPLETE THE FOLLOWING ITEMS:

(Use the reverse side of this sheet, if necessary.)

1. List any terms that were not defined properly.

2. List any errors.

paragraph	error	correction

3. List any suggestions you have to improve this subcourse.

4. Student Information (optional)

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