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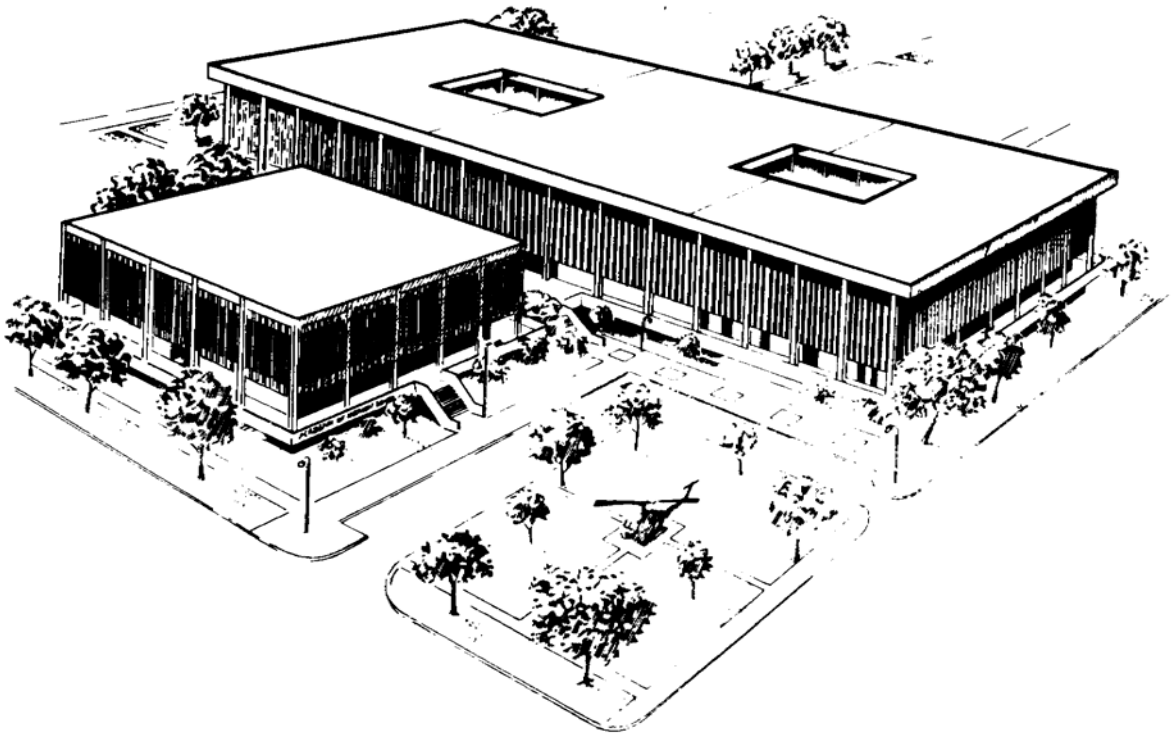

MANAGEMENT OF PATIENTS WITH RESPIRATORY DYSFUNCTIONS

SUBCOURSE MD0542 EDITION 100

DEVELOPMENT

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CORRESPONDENCE COURSE OF THE
U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0542

MANAGEMENT OF PATIENTS WITH RESPIRATORY DYSFUNCTION

INTRODUCTION

This subcourse presents a review of the respiratory system, devices such as the oralpharyngeal airway and bag-valve-mask (BVM) systems which are used to assist a patient's breathing efforts, procedures for supplying the patient with additional oxygen through the use of the face mask and nasal prongs, and procedures for removing secretions interfering with breathing through the use of suction.

Successful completion of this subcourse does not mean that you are ready to begin managing patients with respiratory dysfunctions. You must still be trained under the supervision of a person who is qualified to instruct you in these processes, supervise your practice, and carefully evaluate your skills and abilities.

Subcourse Components:

This subcourse consists of four lessons. The lessons are as follows:

Lesson 1, The Respiratory System.
Lesson 2, Devices Used to Aid Breathing.
Lesson 3, Administering Oxygen
Lesson 4, Oral, Nasopharyngeal, and Nasotracheal Suctioning

Credit Awarded:

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Section at Fort Sam Houston, Texas. Upon successful completion of the examination for this subcourse, you will be awarded 6 credit hours.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

LESSON ASSIGNMENT

LESSON 1	The Respiratory System.
LESSON ASSIGNMENT	Paragraphs 1-1 through 1-11.
LESSON OBJECTIVES	After completing this lesson, you will be able to: 1-1. Describe the respiration processes. 1-2. Identify the components of the respiratory system and their functions.
SUGGESTIONS	After completing the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

THE RESPIRATORY SYSTEM

1-1. GENERAL

a. The cells of the body require a constant supply of oxygen to carry on the chemical processes necessary to life. Because of these processes, carbon dioxide (a waste product) is formed and must be removed from the body so that the cells do not become poisoned by their own wastes. Oxygen and carbon dioxide are continuously being exchanged, both between the body and the atmosphere and within the body, by the physiological process known as respiration. The system that performs the exchange of gases between the body and the atmosphere is the respiratory system.

b. There are two types of respiration--external and internal. External respiration is the exchange of gases between the air in the lungs and blood. Internal respiration is the exchange of gases between the blood and the individual cells of the body.

c. Breathing is the mechanical process that moves air into and out of the lungs. There are two types of breathing in humans--costal (thoracic) and diaphragmatic (abdominal). In costal breathing, the major structure causing the movement of the air is the rib cage. In diaphragmatic breathing, the diaphragm causes the air to move into and out of the lungs.

1-2. COMPONENTS AND SUBDIVISIONS OF THE RESPIRATORY SYSTEM

a. **Components**. The human respiratory system consists of air passageways and two lungs (figure 1-1). Air moves from the outside of the body through the air passages into tiny sacs in the lungs called alveoli.

b. **Main Subdivisions**. The main subdivisions of the respiratory system may be identified by their relationship to the voice box (larynx). Thus, the main subdivisions are as follows:

(1) Supralaryngeal (above the larynx) structures. These structures include the external nose, nasal chambers, and pharynx. These structures cleanse, warm, moisten, and test inflowing air.

(2) Larynx (voice box). This structure controls the volume of inflowing air and produces selected pitch (vibration frequency) in the moving column of air.

(3) Infralaryngeal (below the larynx) structures. These structures include the trachea, bronchi, alveoli, lungs, and pleural cavities. They distribute air to the alveoli of the lungs where the actual external respiration takes place.

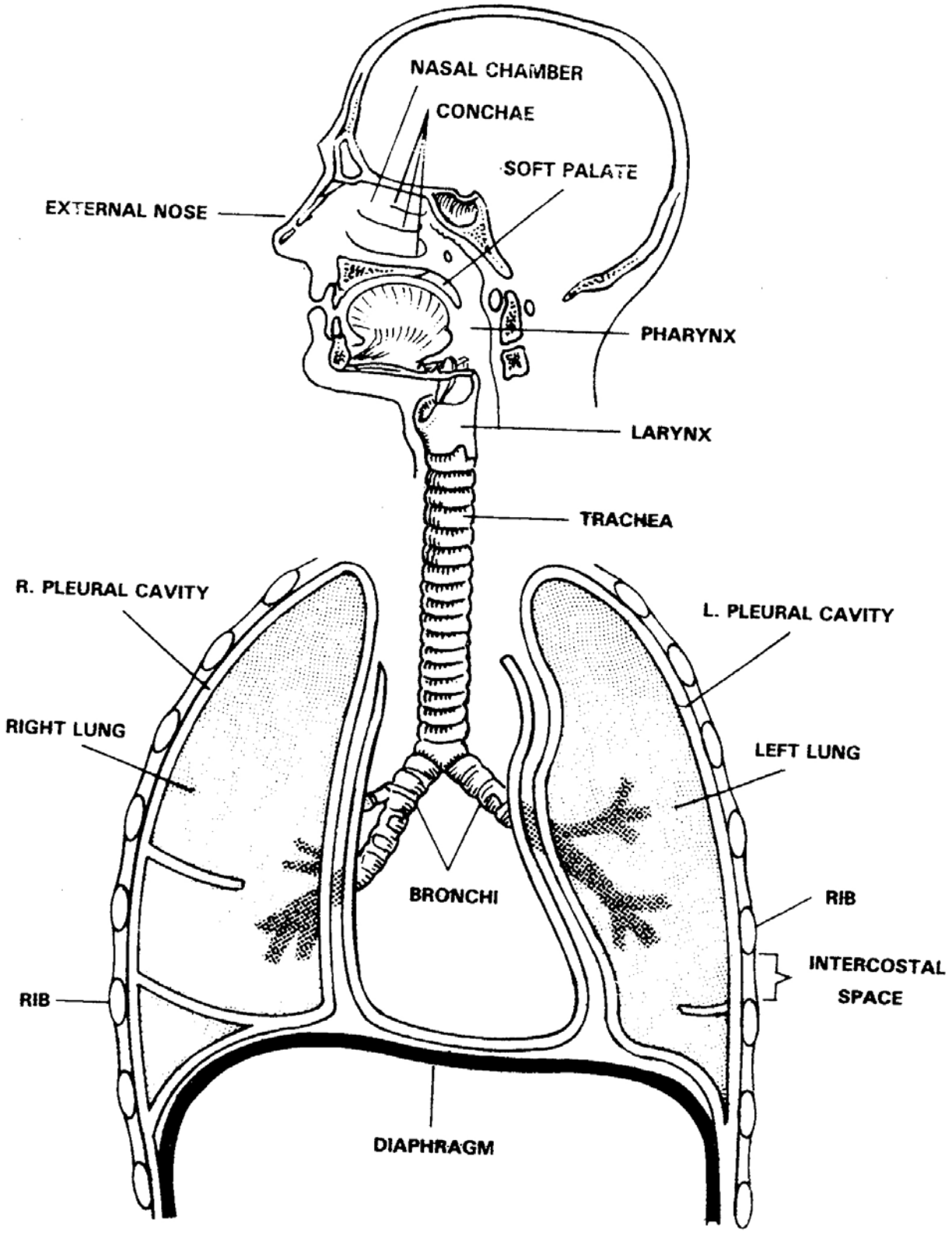


Figure 1-1. The human respiratory system.

1-3. SUPRALARYNGEAL STRUCTURES

Supralaryngeal structures are shown in figure 1-2.

a. **External Nose**. The external nose is the portion projecting from the face. It is supported primarily by cartilages. It has a midline divider, called the nasal septum, which extends from the internal nose. There are paired openings (nostrils) that lead to paired spaces (vestibules). Guard hairs in the nostrils filter inflowing air.

b. **Nasal Chambers (Internal Nose)**. Behind each vestibule of the external nose is a nasal chamber. The two nasal chambers together form the internal nose. These chambers, too, are separated by the nasal septum.

(1) The walls of the nasal chambers are lined with a thick mucous-type membrane known as the mucoperiosteum. It has a ciliated (hair-like projection that move fluids to the rear) epithelial surface. It also has a rich blood supply that provides warmth and moisture. At times, the membrane may become quite swollen.

(2) The lateral wall of each chamber has three scroll-like extensions into the nasal chamber that help to increase the surface area exposed to the inflowing air. These scroll-like extensions are known as conchae.

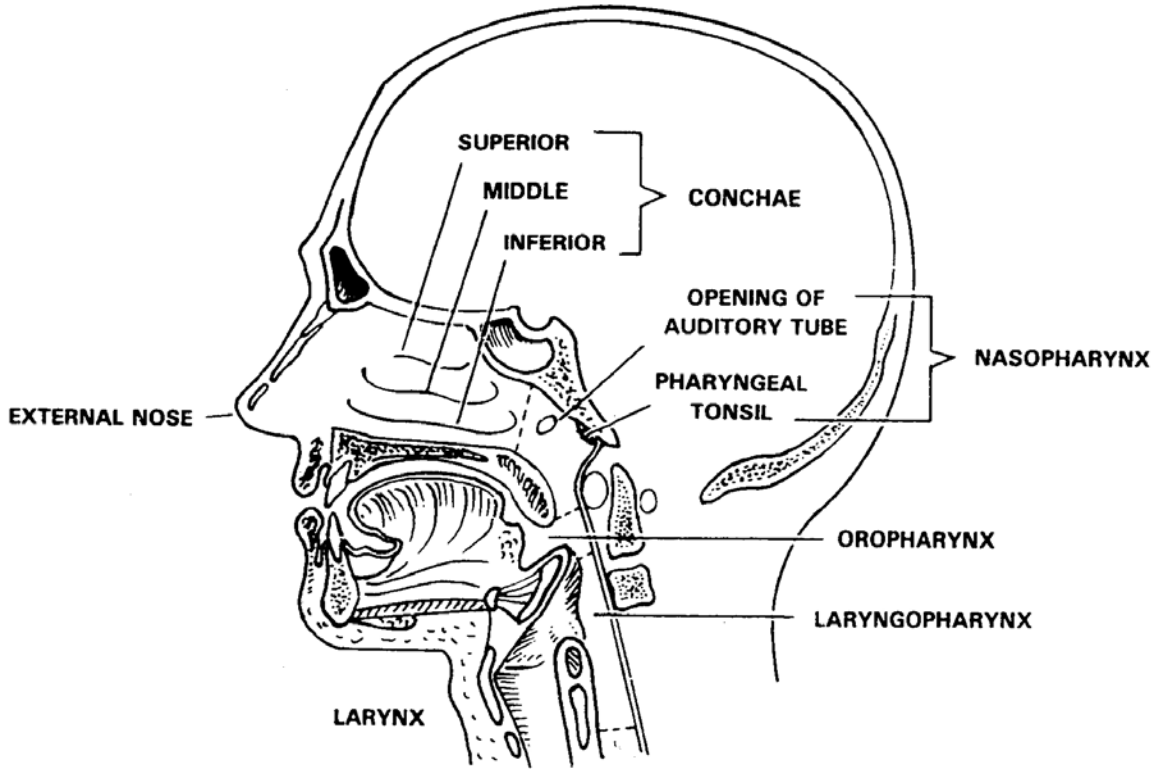


Figure 1-2. Supralaryngeal structures.

(3) The sense of smell is caused by special nerve endings located in the upper areas of the nasal chambers. The epithelium containing the sensory ending is known as the olfactory epithelium.

(4) There are air "cells" or cavities in the skull called paranasal sinuses. The paranasal sinuses are connected with nasal chambers and are lined with the same ciliated mucoperiosteum. Thus, these sinuses are extensions of the nasal chambers into the skull bones. For this reason, they are known as paranasal sinuses.

c. **Pharynx**. The pharynx is the common posterior space for the respiratory and digestive systems.

(1) The portion of the pharynx specifically related to the respiratory system is the nasopharynx. It is the portion of the pharynx above the soft palate. The two posterior openings (nares) of the nasal chambers lead into the single space of the nasopharynx. The auditory (eustachian) tubes also open into the nasopharynx. The auditory tubes connect the nasopharynx with the middle ears. This allows the pressure between the outside and inside of the eardrum to be equalized. Lying in the upper posterior wall of the nasopharynx are the pharyngeal tonsils (adenoids). The soft palate floor of the nasopharynx is a trapdoor that closes off the upper respiratory passageways during swallowing.

(2) The portion of the pharynx closely related to the digestive system is the oropharynx. It is the portion of the pharynx below the soft palate and above the upper edge of the epiglottis. The epiglottis is the flap that prevents food from entering the larynx when a person swallows.

(3) The portion of the pharynx that is common to both the respiratory system and the digestive system is the laryngopharynx. It is the portion of the pharynx below the upper edge of the epiglottis. Thus, the digestive and respiratory systems lead into it from above and lead off from it below.

1-4. LARYNX

The larynx, also called the Adam's apple or voice box, connects the pharynx with the trachea. The larynx is located in the anterior neck region and has a box-like shape (figure 1-3). The larynx of the male becomes larger and heavier during puberty and causes the voice to deepen. The adult male's larynx tends to be located lower in the neck. In the female, the larynx remains higher and smaller.

a. The larynx has a vestibule ("entrance hallway") that can be covered over by the epiglottis. The glottis itself is the hole between the vocal cords. Through the glottis, air passes from the vestibule into the main chamber of the larynx (below the cords) and then into the trachea. The skeleton of the larynx is made up of a series of cartilages.

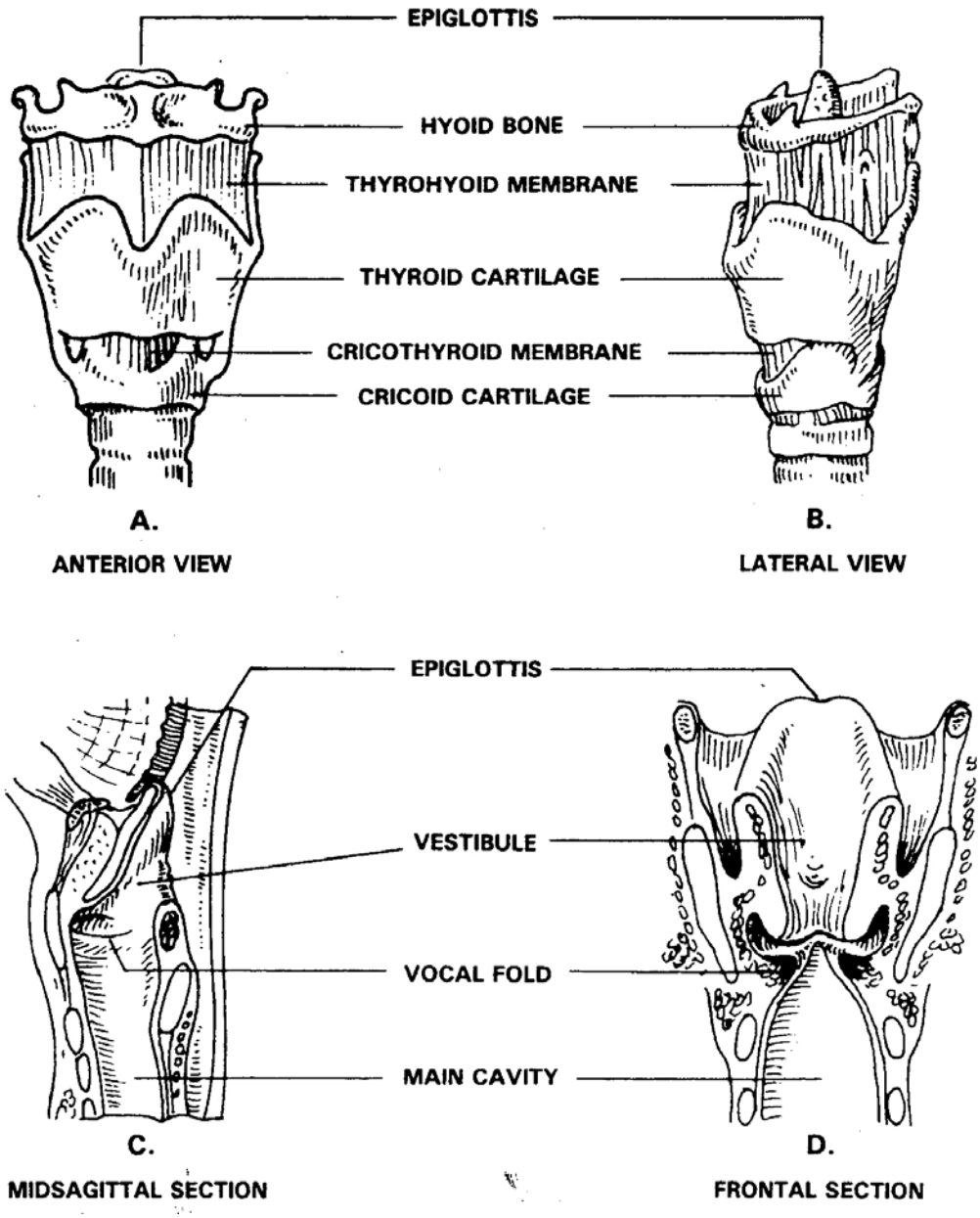


Figure 1-3. The larynx.

b. The larynx serves two functions and has two sets of muscles--one for each function.

(1) One set controls the size of the glottis. Thus, it regulates the volume of air passing through the trachea.

(2) The other set controls the tension of the vocal cords. Thus, it produces vibrations of selected frequencies (variations in pitch) of the moving air used in the process of speaking.

1-5. INFRALARYNGEAL STRUCTURES

Infralaryngeal structures are shown in figure 1-4.

a. **Trachea and Bronchi**. The respiratory tree is the set of tubular structures that carry the air from the larynx to the alveoli of the lungs. The respiratory tree is so named because it has the appearance of an inverted tree with its trunk and branches. These tubular parts are held open (made patent) by rings of cartilage. Their lining is ciliated to remove mucus and other materials that get into the passageway.

b. **Alveoli**. The alveoli are tiny spherical balloon-like sacs that are connected to the larger tubes of the lungs by alveolar ducts and bronchioles. The alveoli are so small that there are billions in the adult lungs. This very small size produces a maximum surface area through which external respiration takes place. External respiration is the actual exchange of gas between the air, the alveolar spaces, and the adjacent blood capillaries through their wall. (Note: Alveoli is the plural of alveolus.)

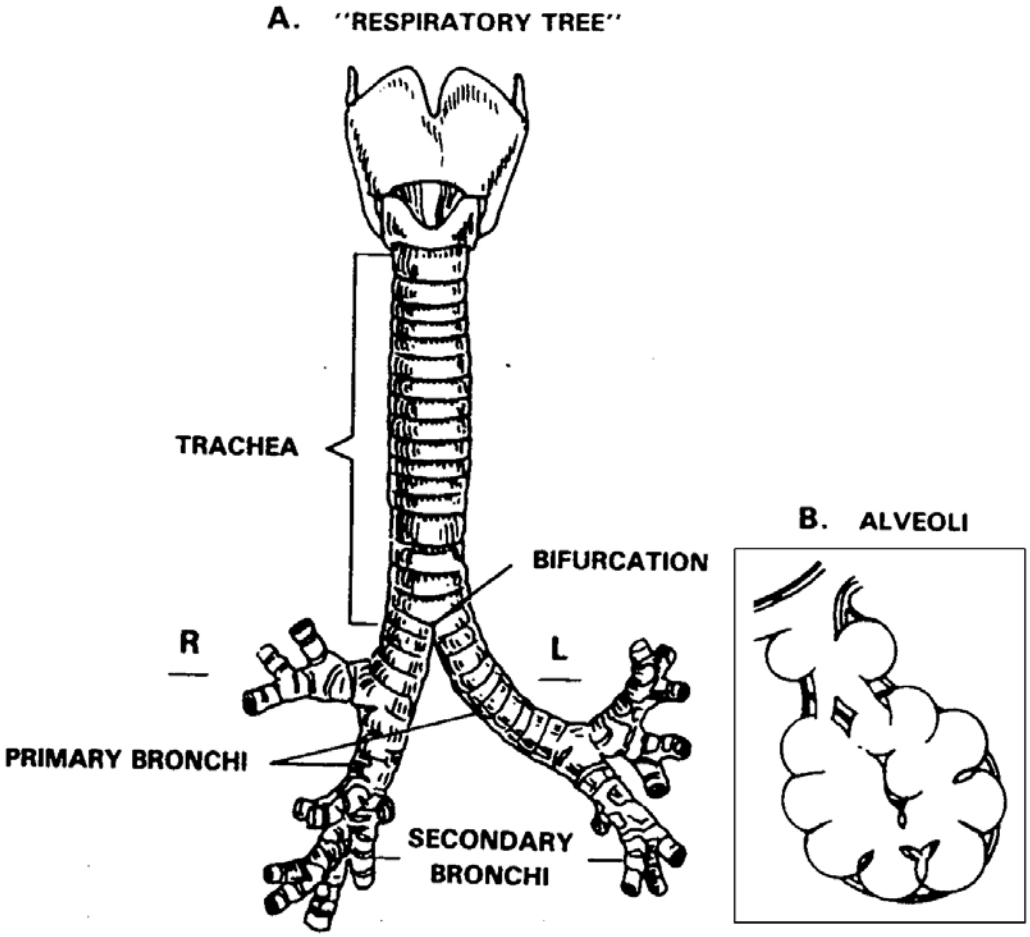


Figure 1-4. Infralaryngeal structures.

c. **Lungs**. A lung is an individual organ composed of tubular structures and alveoli, bound together by fibrous connective tissue. In the human, there are two lungs--right and left. Each lung is divided into lobes. A pulmonary lobe is a major subdivision of a lung marked by fissures (deep folds). Each lobe is further partitioned into bronchopulmonary segments.

(1) The right lung is larger in volume than the left lung since the left lung must leave room for the heart. The right lung is divided into three pulmonary lobes (upper, middle, and lower) and ten bronchopulmonary segments (2+3+5). The left lung is divided into two pulmonary lobes (upper and lower) and eight bronchopulmonary segments (4+4).

(2) Each lung is supplied by a primary or mainstream bronchus leading off the trachea. Each lobe is supplied by a secondary or lobar bronchus branching off of the primary bronchus. Each segment is supplied by a tertiary or segmented bronchus, a branch of the lobar bronchus.

d. **Pleural Cavities**. Each lung is encased in a serous cavity called the pleural cavity. Each serous cavity has inner and outer membranes. The serous membranes secrete fluid that act as a lubricant between the membranes, allowing freer motion for the organs. The pleural cavities allow the lungs to move freely with a minimum of friction during the expansion and contraction phases of breathing. Located in the middle of the thorax, between the two pleural cavities, is the mediastinum ("I stand between"). The mediastinum is a tissue and organ-filled space. Within it is the heart, which is located at the same level as the lungs.

1-6. BREATHING AND BREATHING MECHANISMS

a. Boyle's law (named after Robert Boyle, British physicist, 1627-1691) states that as the volume of a gas-filled container increases, the pressure inside decreases. Conversely, as the volume of a closed container decreases, the pressure inside increases. When two connected spaces of air have different pressures, the air moves from the space with greater pressure to the one with lesser pressure. In regard to breathing, we can consider the air pressure around the human body to be constant. The pressure inside the lungs may be greater or less than the pressure outside the body. Thus, a greater internal pressure causes air to flow out; a greater external pressure causes air to flow in.

b. The human trunk can be compared to a hollow cylinder. This cylinder is divided into upper and lower cavities by the diaphragm. The upper is the thoracic cavity and is essentially gas-filled. The lower is the abdominopelvic cavity and is essentially water-filled. By changing the size (volume) of the thoracic cavity, air can be forced into and out of the cavity. The size of the thoracic cavity is changed by movement of the rib cage (coastal or thoracic breathing) and by movement of the diaphragm (diaphragmatic or abdominal breathing).

1-7. COSTAL (THORACIC) BREATHING

Muscles attached to the thoracic cage (rib cage) cause the chest to expand during inhalation and return to normal during exhalation.

a. **Inhalation**. Muscles attached to the thoracic cage contract and raise the ribs. A typical rib might be compared to a bucket handle, attached at one end to the sternum (breastbone) and at the other end to the vertebral column (spine). The "bucket handle" is lifted by the overall upward and outward movement of the rib cage. These movements increase the thoracic diameters from right to left (transverse) and from front to back. Thus, the volume within the chest increases. Recalling Boyle's law, the increase in volume leads to a decrease in pressure. The higher air pressure outside the body then forces air into the lungs and inflates them.

b. **Exhalation**. The rib cage movements and pressure relationships are reversed for exhalation. The muscles relax, the ribs return to their normal position, and the size of the chest decreases. The pressure within the chest increases and forces air outside the body.

1-8. DIAPHRAGMATIC (ABDOMINAL) BREATHING

The diaphragm is a thin, but strong, dome-shaped muscular membrane that separates the abdominal and thoracic cavities. The abdominal wall is elastic in nature. The abdominal cavity is filled with soft, watery tissues.

a. **Inhalation**. As the diaphragm contracts, the dome flattens and the diaphragm descends. This increases the depth (vertical diameter) of the thoracic cavity and thus increases its volume. This decreases air pressure within the thoracic cavity. The greater air pressure outside the body then forces air into the lungs.

b. **Exhalation**. As the diaphragm relaxes, the elastic abdominal wall forces the diaphragm up again by pushing the watery tissues of the abdomen against the underside of the relaxed diaphragm. The dome moves upward, the volume of the thoracic cavity is decreased, and air is forced from the lungs and into the atmosphere.

1-9. NERVOUS CONTROL OF BREATHING

Breathing can be controlled voluntarily to some extent, such as holding your breath for a short period of time or breathing deeply during a medical examination. However, breathing is usually controlled by the nervous system without the need to consciously order the body to inhale or exhale. Respiratory reflexes are controlled by the respiratory center found in the medullary portion of the brainstem. The respiratory center coordinates the actions of costal breathing and diaphragmatic breathing to ensure that they work together (chest and abdominal muscles contract at the same time and relax at the same time). The amount of carbon dioxide (CO_2) in the circulating blood is one of the major influences on the actions of the respiratory center.

1-10. MOVEMENT OF BLOOD

a. The veins of the systemic blood circulatory system bring oxygen-poor blood from all parts of the body to the right atrium of the heart. From the right atrium, the blood flows into the right ventricle of the heart. Upon contraction of the right ventricle, blood is forced into the pulmonary arch. The pulmonary arch divides into the right and left pulmonary arteries that delivers the oxygen-poor blood to their respective lungs. Paralleling the branching of the respiratory tree, the arteries divide and subdivide within the lungs. These arteries lead to capillaries that surround the alveoli. The walls of these capillaries are thin enough to accommodate the passage of gases to and from the alveolus. The oxygen-poor blood gives up the carbon dioxide which it has been carrying and absorbs oxygen from the alveolus. Just as oxygen travels from the alveolus to the capillary, carbon dioxide travels from the capillary to the alveolus.

b. The blood, now saturated with oxygen, is collected by the pulmonary venous system. The blood flows through the pulmonary veins into the left atrium of the heart. From the left atrium, it flows into the left ventricle. When the left ventricle contracts, the oxygen-rich blood is forced into the aorta of the systemic blood circulatory system. Other arteries branch off of this large artery and carry the oxygen-rich blood to all living cells within the body. As the arteries continue to subdivide and get smaller, they eventually reach the capillary stage. At this stage, oxygen moves from the blood into the surrounding body cells and carbon dioxide, a waste material, travels from the body cells to the blood. The blood then flows from the capillaries into veins and eventually returns to the right atrium of the heart.

1-11. TRANSPORTATION OF GASES

Oxygen and carbon dioxide are the primary gases involved in respiration. Under special circumstances, nitrogen may also be of concern. Some of the gases are dissolved directly in the plasma of the blood. Most of the gasses, however, are carried within the erythrocytes (red blood cells, commonly called RBCs). The RBCs, found in great numbers in the blood, are specially constructed for transporting the gases. Hemoglobin, a substance found within RBCs, has a great affinity for oxygen. Yet, the hemoglobin can readily give up the oxygen wherever it is needed.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS. Answer the following items by completing the statement or by writing the answer in the space provided at the end of the item.

After you have completed all of these items, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Name and define the two types of respiration.

   a. _____

   _____

   b. _____

   _____

2. What does the larynx control?

   _____

3. What is found in the nose to filter inflowing air

   _____

4. The walls of the nasal chambers are lined with a thick mucous-type membrane called the _____.

5. The common posterior space for the respiratory and digestive systems is called the _____.

6. The part of the pharynx that is related to the respiratory system is the:

   _____.

7. The tubes that are used to equalize the pressure between the outside and inside of the eardrum are called _____.

8. How is the upper respiratory passageway closed when the person swallows food?

_____

_____

9. Which flap prevents food from entering the larynx during swallowing?

_____

10. The two common terms that refer to the larynx are _____ and _____.

11. Describe the alveoli.

_____

_____

12. Which lung is the smaller lung and why?

_____

_____

13. Where is the mediastinum located?

_____

_____

14. How is Boyle's law related to a person's breathing?

_____

_____

_____

_____

15. During inhalation, how is the rib cage lifted?

_____

_____

16. Describe the action of the diaphragm during inhalation.

_____

_____

_____

_____

17. Which part of the brain controls the respiratory reflexes?

_____

_____

18. The primary gases involved in respiration are _____ and

_____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. External respiration is the exchange of gases between the air in the lungs and blood.
   Internal respiration is the exchange of gases between the blood and the individual cells of the body. (para 1-1b)

2. The larynx controls the volume of inflowing air and produces selected pitch (vibration frequency) in the moving column of air. (para 1-2b(2))

3. Hairs in the nose filter inflowing air. (para 1-3a)

4. Mucoperiosteum. (para 1-3b(1))

5. Pharynx. (para 1-3c)

6. Nasopharynx. (para 1-3c(1))

7. Auditory (eustachian) tubes. (para 1-3c(1))

8. The soft palate floor of the nasopharynx is a trapdoor that closes off the upper respiratory passageways during swallowing. (para 1-3c(1))

9. The epiglottis. (para 1-3c(2))

10. Adam's apple and voice box. (para 1-4)

11. The alveoli are tiny spherical (balloon-like) sacs that are connected to the larger tubes of the lungs by alveolar ducts. (para 1-5b)

12. The left lung is smaller because it must leave room for the heart. (para 1-5c)

13. The mediastinum is found in the middle of the thorax, between the two pleural cavities. (para 1-5d)

14. When the volume of the chest cavity decreases, the air pressure inside the lungs increases and forces to flow out from the lungs. When the volume of the chest cavity increases, the air pressure inside the lungs decreases and causes air to flow in. (para 1-6a)

15. Muscles attached to the thoracic cage raise the rib cage during inhalation. (para 1-7a)

16. As the diaphragm contracts, the dome flattens and the diaphragm descends, thereby increasing the size of the thoracic cavity. This results in decreased air pressure within the thoracic cavity. The greater air pressure outside the body forces air into the lungs. (para 1-8a)

17. The respiratory center located in the brainstem. (para 1-9a)

18. Oxygen and carbon dioxide. (para 1-11)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	Devices Used to Aid Breathing.
LESSON ASSIGNMENT	Paragraphs 2-1 through 2-4.
LESSON OBJECTIVES	After completing this lesson, you will be able to:

2-1. List/identify the steps used to insert an oropharyngeal airway.

2-2. Identify when an oropharyngeal airway should be used.

2-3. List/identify the steps used to ventilate a patient with a bag-valve- mask system.

2-4. Identify the procedures used to assist the patient's breathing.

2-5. Identify the advantages and disadvantages of the bag-valve-mask system.

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

LESSON 2

DEVICES USED TO AID BREATHING

Section I. OROPHARYNGEAL AIRWAY

2-1. OROPHARYNGEAL AIRWAYS (J-TUBES)

There will be situations in the field where you will encounter a patient who not only needs his breathing restored, but must also have it maintained by mechanical means. In the field, rescue breathing is the preferred method of maintaining respiration. Before any airway adjuncts are utilized, it should be remembered that the airway can be improved in most cases by tilting the head back and performing the chin lift or jaw thrust. These maneuvers displace the tongue forward and away from the posterior pharyngeal wall. If the patient is capable of spontaneous breathing, this positioning may be all that is necessary. In some situations, however, an oropharyngeal airway may be needed to maintain an open air passage.

a. The oropharyngeal airway is a semicircular apparatus of plastic, rubber, or metal. The apparatus is also called a J-tube because of its shape. It is curved to fit over the back of the tongue and is inserted into the lower posterior wall of the pharynx. In this location, the apparatus will hold the tongue away from the posterior wall of the pharynx and keep the patient's airway patent (open).

b. The insertion of any mechanical breathing device is advised only when the patient is unconscious and is not having convulsions and when the preferred manual methods (head-tilt chin-lift, etc.) are not practical or possible. Before inserting the airway, attempt normal resuscitation procedures (rescue breathing).

2-2. PROCEDURE FOR INSERTING AN OROPHARYNGEAL AIRWAY

a. **Determine Need for Oropharyngeal Airway.** Before you insert an oropharyngeal airway (J-tube), you must survey the patient, open the airway, clear the upper airway of obstruction (if applicable), and perform rescue breathing. If the patient begins breathing on his own but does not regain consciousness and you are unable to stay with the patient to keep his airway open, a J-tube may be inserted in order to keep the patient's airway patent.

b. **Select the Proper Size Oropharyngeal Airway.** To select the correct size of airway, select one of the J-tubes (figure 2-1) and hold it alongside the patient's jaw (jaw in the normal position with the mouth closed). Then measure from the corner of the patient's mouth to the bottom tip of his ear. Use the J-tube that best matches this measurement.

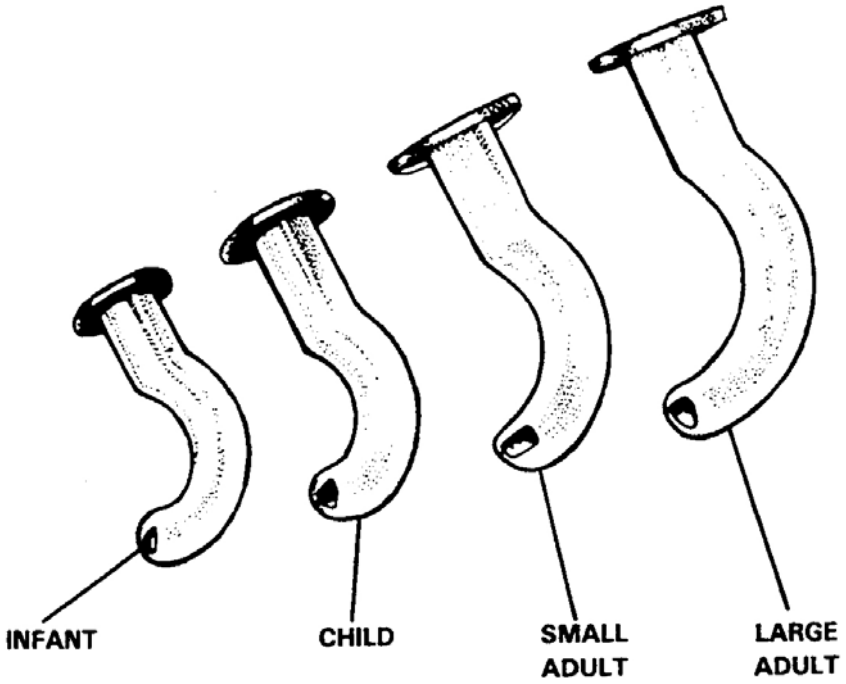


Figure 2-1. J-tubes.

c. **Open the Patient's Airway.** Open the patient's mouth using the crossed-finger method.

(1) Place your crossed thumb and index finger of one hand on the patient's upper and lower teeth at the corner of the mouth (figure 2-2).

Figure 2-2. Opening the patient's mouth.

(2) Use a scissor motion to pry the teeth apart and hold the mouth open. If the patient's teeth are clenched, use the modified jaw thrust method to open the mouth. In cases where neck or spinal injuries are present or suspected, use the jaw thrust method of opening the airway to prevent further injury.

(3) Hyperextend the patient's neck (figure 2-3) unless there is a suspected spinal injury.

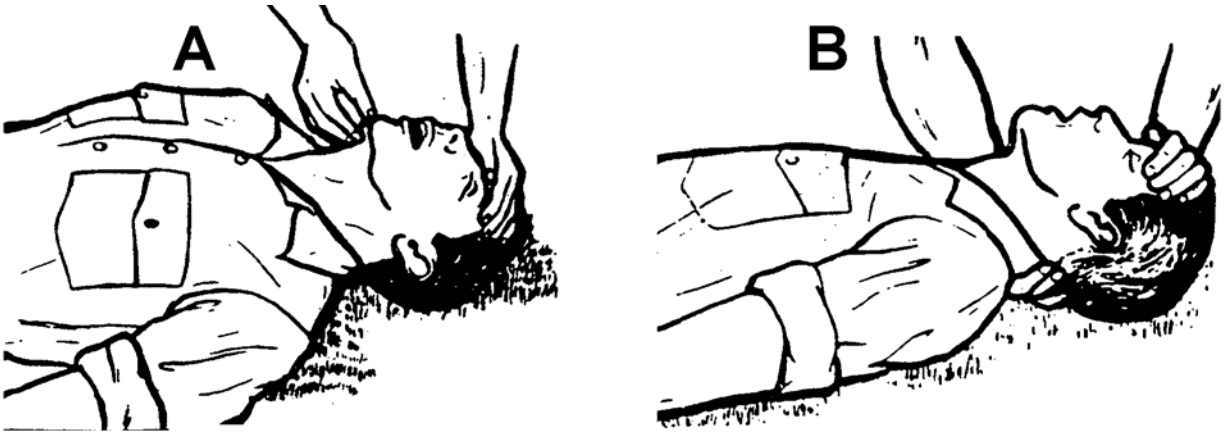


Figure 2-3. Hyperextending the neck. A Head-tilt, chin-lift. B Head-tilt, neck-lift.

d. **Insert the Oropharyngeal Airway.** Remember, the oropharyngeal airway is used for UNCONSCIOUS patients only. Do not try to insert the artificial airway in a conscious or semi-conscious patient due to the patient's gag reflex. The presence of an airway in such patients may induce vomiting and cause aspiration of the stomach contents into the lungs.

(1) Place the tip of the airway into the patient's mouth (figure 2-4).

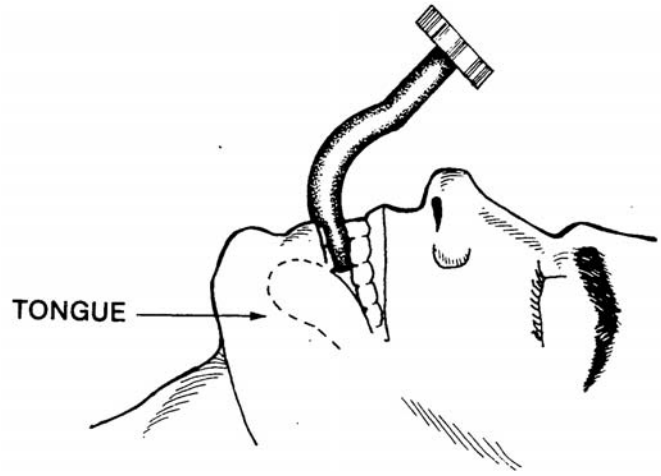


Figure 2-4. Tip of the oropharyngeal airway placed into the mouth.

(2) Point the tip of the airway toward the roof of the patient's mouth to prevent the tongue from being pushed into the back of the throat.

(3) Slide the airway along the roof of the mouth, following the natural curvature of the tongue, past the soft palate.

(4) Rotate the airway 180 degrees as the tip reaches the back of the tongue (figure 2-5).

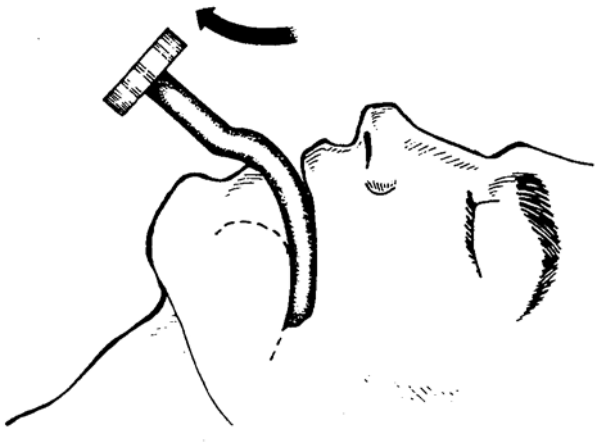


Figure 2-5. Tip of the J-tube at the back of the tongue.

(5) Gently advance the airway and adjust it so the flange rests on the patient's lips. If the flange of the airway does not seat properly or if the patient begins to gag or vomit, the airway may be the wrong size. The tip of the airway should rest just above the epiglottis (figure 2-6).

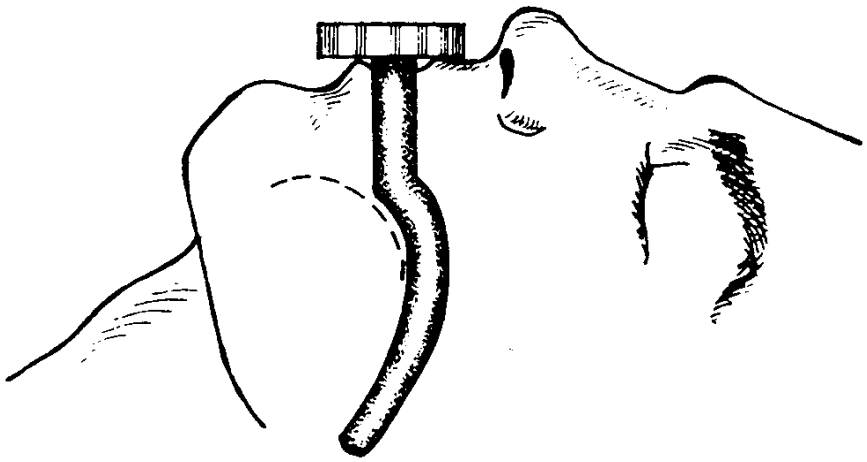


Figure 2-6. J-tube in place.

(6) If you have any difficulty inserting the airway, grasp the tongue with your index finger and thumb (using a gauze pad, if available) and pull the tongue forward or use a tongue blade to depress the tongue.

e. **Remove Oropharyngeal Airway, If Needed.** When the patient starts to regain consciousness or gags, remove the airway quickly to prevent regurgitation and possible aspiration of stomach contents.

f. **Record Treatment and Evacuate the Patient.**

(1) Complete a Field Medical Card and attach the card to the patient's clothing.

(2) Evacuate the patient for further evaluation and treatment by a physician. If the oropharyngeal airway is still in place, it may need to be taped or tied to keep it from being dislodged during evacuation. If the oropharyngeal airway is secured in place, the patient must be watched constantly so that the airway can be removed in the event he becomes conscious. During evacuation, check the airway periodically to ensure that it is free from obstacles and is functioning properly.

Section II. BAG-VALVE-MASK SYSTEM

2-3. BAG-VALVE-MASK SYSTEMS

a. The primary function of the bag-valve-mask (BVM) system is to deliver a high concentration of supplemental oxygen (above 55 percent) and simultaneously ventilate the patient. When using the BVM system with an unconscious patient, the use of an oropharyngeal airway is desirable in order to maintain the patient's airway.

b. The primary advantages of the BVM system over the mouth-to-mouth and mouth-to-nose methods are user convenience and the ability to deliver enriched oxygen mixtures. However, the mouth-to- mouth and mouth-to-nose methods can deliver a greater volume of air (up to four liters at a time) than the BVM system (usually one liter). The BVM system may also be used with or without supplemental oxygen to assist the efforts of a spontaneously breathing patient who is having difficult respirations.

c. There are many different BVM systems in use. Most of them use these following items:

(1) A self-inflating bag.

(2) A nonreturn valve to prevent rebreathing exhaled air.

(3) A face mask, usually made of clear plastic so that vomitus or secretions around the patient's mouth can be seen.

(4) An inlet for supplemental oxygen delivery.

d. Most systems have oxygen reservoir bags and adaptors for use with endotracheal and tracheostomy tubes. The type of supplemental oxygen delivery system used depends on the patient's ability to adequately inhale a sufficient volume of air. If he is unable to inhale efficiently, a BVM system is used to force a greater volume of air and oxygen into the lungs. If the patient requires an increase in oxygen content and is able to inhale adequately, a simple face mask or nasal prongs is preferred if available.

2-4. PROCEDURE FOR VENTILATING THE PATIENT USING A BAG-VALVE-MASK SYSTEM

a. **Survey the Patient.** Visually check the patient for obvious causes of breathing difficulty. If no difficulties are evident, check further to determine his ability to breathe on his own.

b. **Position Yourself and Patient.** Position yourself behind the patient's head. In a hospital situation, the headboard of the bed may have to be removed or the patient moved partially across the bed to bring his head closer to the edge of the bed.

c. **Insert Oropharyngeal Airway, if Appropriate.** If the patient is unconscious, insert an oropharyngeal airway (J-tube) in order to keep the airway open while you use the BVM. If the patient is conscious or semi-conscious, do not use the J-tube.

d. **Stretch Mask.** Check the mask and bag to ensure that they are in working order (no rips, etc.). Then stretch the mask on both sides with your thumbs and fingers (figure 2-7) so that the mask will fit the patient.

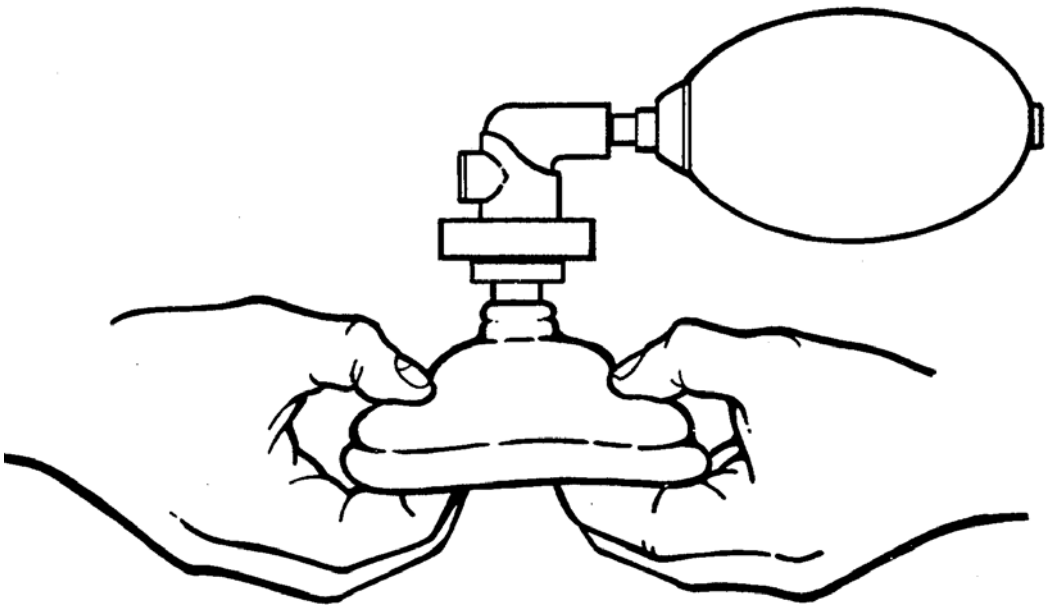


Figure 2-7. Stretching the mask.

e. **Seat Mask.**

(1) Place the mask over the patient's nose and mouth to so that it fits over the bridge of the nose, extends below the lower lips (figure 2-8), and forms a tight seal. As the stretched mask is positioned on the patient's face, it will return to its original shape and the patient's skin will be pulled slightly inward.

Figure 2-8. Positioning the mask.

(2) Place your thumb and index finger of one hand on the mask. Position the thumb above and the finger below the valve connection. Use the other fingers (on the same hand) to grip the lower jaw in order to maintain the tight seal of the mask (figure 2-9).

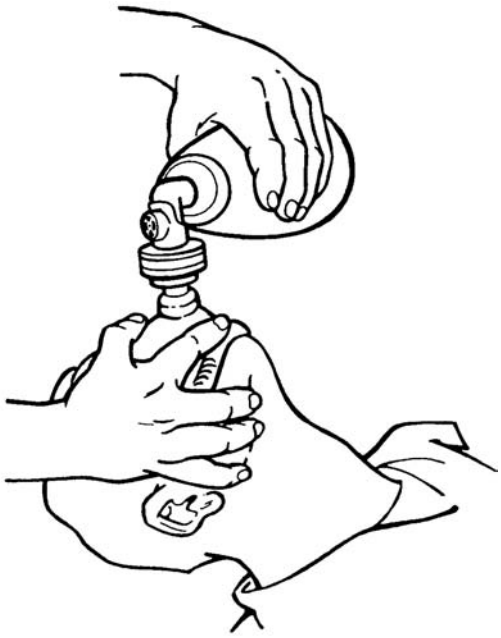


Figure 2-9. Giving ventilations using BVM.

f. **Begin Ventilations.** Perform ventilations by squeezing the bag with the hand that is not holding the mask in place (figure 2-9).

(1) Squeeze four initial quick breaths with the bag.

(2) Thereafter, use your other hand to squeeze the bag in a rhythmical manner once every five seconds to give a rate of twelve breaths per minute.

(3) An oxygen source may be attached to the mask if available and ordered by a physician.

NOTE: When the BVM system is used to assist the breathing of a spontaneously breathing patient, time the ventilations so they will coincide with the patient's inhalations by observing the rise and fall of his chest. Try to obtain a more normal rate and depth of respirations.

g. **Check for Effectiveness.** Observe the patient's chest to see if it rises and falls. If the chest does not rise and fall, reopen or clear the airway. If the rising and falling chest movement is observed, continue to ventilate the patient.

h. **Continue Ventilations.** Continue to ventilate the patient at a rate of one breath every five seconds until spontaneous breathing returns. When the patient begins to breathe on his own again, time your ventilations to correspond to the patient's inhalations. Continue until the patient's respirations attain a normal rate and depth or until you are ordered to stop by a physician.

i. **Evacuate, if Needed.** In a field situation, you may need to prepare a Field Medical Card and evacuate the patient for further evaluation and treatment by a physician. Maintain adequate ventilation en route, if necessary.

j. **Clean the BVM system.** The BVM system must be cleaned in accordance with the manufacturer's specifications after each use. The cleaning prevents the spread of microorganisms from one patient to another and helps to prevent equipment malfunction.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTION. The following exercises are to be answered 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 the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Why is the J-tube not used for conscious and semi-conscious patients?

   _____

   _____

2. When do you remove the airway?

   _____

   _____

3. List the steps to follow when inserting a J-tube after the patient's airway has been opened.

   _____

   _____

   _____

   _____

4. What do you do if you have difficulty keeping the tongue in the proper position while inserting the J-tube?

   _____

   _____

5. List the steps used when putting the mask of a BVM on a patient's face.

_____

_____

_____

_____

6. When restoring the patient's breathing and using the bag-valve- mask system you should first administer _____quick ventilations, then administer one ventilation every _____ seconds.

7. The BVM system must be cleaned in accordance with the manufacturer's specifications after each use. Why?

_____

_____

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. Conscious and semi-conscious patients may still have a gag reflex and the presence of an airway may induce vomiting and cause aspiration of the stomach contents into the lungs. (para 2-2d)

2. When the patient starts to regain consciousness, or gags. (para 2-2e)

3. Place the tip of the airway into the patient's mouth.

   Point the tip of the airway toward the roof of the patient's mouth to prevent the tongue from being pushed into the back of the throat.

   Slide the airway along the roof of the mouth, following the natural curvature of the tongue, past the soft palate.

   Rotate the airway 180 degrees as the tip reaches the back of the tongue.

   Gently advance the airway and adjust it so the flange rests on the patient's lips. (para 2-2d(1) through (5))

4. Grasp the tongue with your index finger and thumb (using a gauze pad, if available) and pull the tongue forward or use a tongue blade to depress the tongue. (para 2-2d(6))

5. Check the mask and bag to ensure that they are in working order.

   Stretch the mask on both sides with your thumbs and fingers.

   Place the mask over the patient's nose and mouth so that it fits over the bridge of the nose and extends below the lower lips and forms a tight seal.

   Place your thumb and index finger of one hand on the mask. Position the thumb above and the finger below the valve connection.

   Grip the patient's lower jaw with the other fingers in order to maintain the tight seal of the mask (para 2-4d, e).

6. Four quick ventilations, one ventilation every five seconds. (paras 2-4f(1), (2), h)

7. This cleaning prevents the spread of microorganisms from one patient to another and helps to prevent equipment malfunction. (para 2-4j)

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3 Administering Oxygen.

LESSON ASSIGNMENT Paragraphs 3-1 through 3-8.

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

3-1. Identify the purpose of oxygen therapy.

3-2. Identify medical conditions that should be treated with oxygen therapy and those that should not be treated with oxygen therapy.

3-3. State the signs, symptoms, and treatment for hypoxemia and hyperventilation.

3-4. State/identify the procedures for setting up an oxygen tank.

3-5. State/identify the procedures for setting up a wall oxygen unit.

3-6. State/identify the procedures for administering oxygen therapy using nasal prongs.

3-7. State/identify the procedures for administering oxygen therapy using a face mask.

3-8. Calculate the duration of flow.

3-9. State/identify procedures for managing the patient on oxygen therapy.

3-10. State/identify safety procedures used with oxygen.

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

LESSON 3

ADMINISTERING OXYGEN

3-1. GENERAL

Oxygen is essential to life. It cannot be stored in the body. The supply of oxygen must be constant and in sufficient amounts to sustain the life of the body's cells. Body tissues die when they are deprived of oxygen. Brain cells can be damaged beyond recovery in three to seven minutes.

3-2. HYPOXEMIA AND OXYGEN THERAPY

Normally, the 21 percent concentration of oxygen in inspired room air is adequate for the body. However, after any severe disturbance of the respiratory or circulatory system, hypoxemia (low level of oxygen in the blood) can occur. Hypoxemia can occur at varying levels. If it is severe, it may cause irreversible tissue damage in a short period of time. Oxygen therapy may be used for acute or chronic conditions that cause hypoxemia.

a. **Signs and Symptoms of Hypoxemia.** Signs and symptoms of hypoxemia include:

(1) Increased heart rate (tachycardia).

(2) Increased respiratory rate (tachypnea).

(3) Difficult or labored breathing (dyspnea).

(4) Shortness of breath.

(5) Restlessness.

(6) Mental confusion and weakness.

(7) Cyanosis (bluish tint of skin--a late sign).

b. **Treatment of Hypoxemia.** Hypoxemia is treated by administering extra oxygen (oxygen therapy). Oxygen is administered in low concentrations to relieve the effects of hypoxemia. Prolonged oxygen therapy and/or high doses may cause respiratory complications such as hyperventilation or atelectasis.

(1) Oxygen is normally supplied from tanks (also called cylinders and bottles) or from wall outlets (piped-in oxygen).

(2) Oxygen is considered a drug and, as such, requires a physician's order before it can be administered to a patient except in certain emergency conditions. The physician will prescribe the dose (flow rate), method (mask or nasal prongs), and duration of the oxygen therapy.

3-3. IDENTIFYING NEED FOR OXYGEN THERAPY

Certain medical conditions require that the patient receive oxygen in greater amounts than is available in the atmosphere. In some medical conditions oxygen therapy is to be avoided (contraindicated).

a. **Conditions That Require Oxygen.**

(1) Cardiac conditions, such as heart attack and congestive heart failure, require oxygen therapy. Congestive heart failure (CHF) is a condition in which the heart fails to maintain an adequate output, resulting in a diminished blood flow to the tissues and congestion in the pulmonary and/or systemic circulation.

(2) Pulmonary edema (an excessive collection of fluid in the pulmonary tissues and air spaces), shock, hemorrhage, or any airway obstruction requires the use of oxygen. An acute respiratory failure and/or pulmonary insufficiency (impaired gas exchange between the circulating blood and the surrounding air) also require the administration of oxygen.

b. **Conditions That <u>Contraindicate</u> Oxygen Therapy.**

(1) <u>Hyperventilation</u>. Hyperventilation is an abnormally rapid breathing rate that produces an excess of oxygen and insufficient carbon dioxide in the blood.

(a) Signs and symptoms. The signs and symptoms of hyperventilation include rapid and unusually deep breathing; extreme anxiety and apprehension; dizziness; numbness of hands, fingers, toes, lips, and tongue; healthy pink color to the skin; stabbing chest pain; flexed position of the hands with thumbs curved toward the palms; and trembling and muscle cramping of the extremities.

(b) Treatment for hyperventilation. Reassure the patient and encourage him to slow his breathing rate. Place a paper bag or other suitable item over the patient's nose and mouth and have him breathe into and from the bag. This causes the patient to rebreathe the exhaled air that has a high concentration of carbon dioxide.

(2) <u>Chronic pulmonary diseases (unless directed by a physician)</u>. These diseases include asthma, chronic bronchitis, and emphysema. These conditions require oxygen to be administered in low doses (1 to 2 liters per minute) ONLY to relieve the symptoms of hypoxemia. Excessive oxygen could lead to respiratory arrest.

3-4. DELIVERY DEVICES

The two major devices for oxygen delivery are the simple face mask and the nasal prongs (cannula). The amount of oxygen delivered is dependent upon the flow rate (given in liters per minute) and the patient's respiration rate.

a. **Nasal Prongs.** The nasal prongs (nasal cannula) is the device most frequently used to administer a low concentration of oxygen. It is a short, disposable, plastic tube with two plastic prongs that fit into the patient's nostrils. It is held in place with an elastic headband (figure 3-1). The nasal cannula is relatively comfortable and enables the patient to eat, talk, and move without difficulty; however, the prongs can be easily dislodged by restless or disoriented patients. To be effective, the patient's nasal passages must be clear.

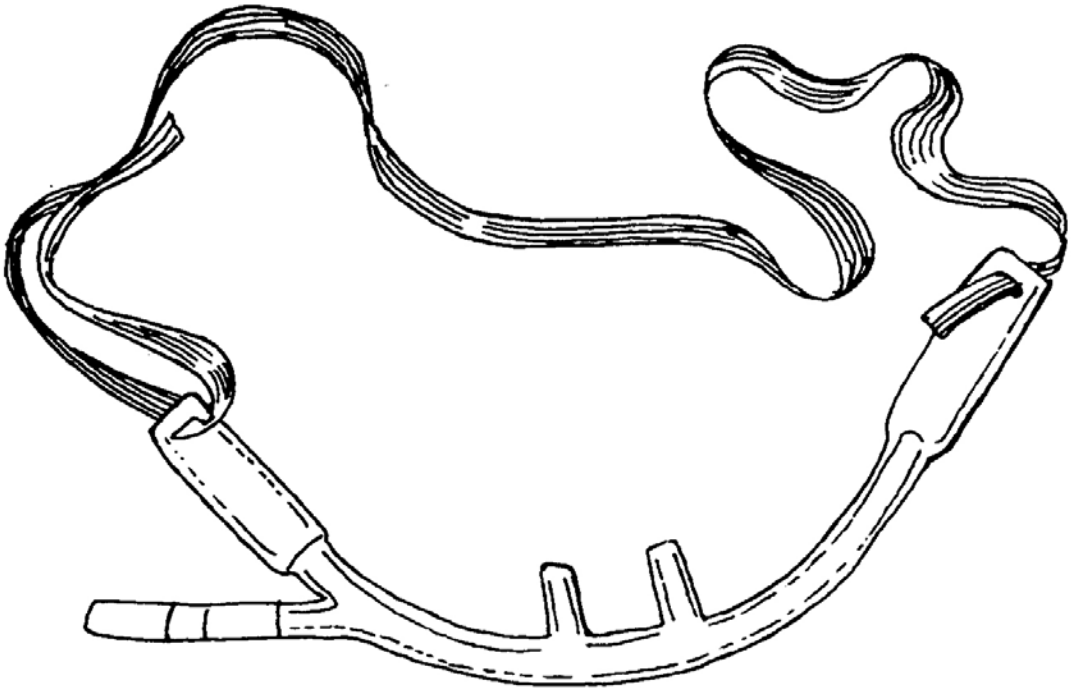


Figure 3-1. Nasal cannula.

b. **Face Mask.** The most commonly used oronasal face mask is a disposable, clear plastic type that covers the nose and mouth (figure 3-2). Exhaled air passes through small holes in the sides of the mask. These holes also allow room air to be drawn in and mixed with the oxygen (figure 3-3). This device must be used with caution with patients who may be unable to maintain a clear airway, including patients who may vomit easily and are unable to remove the mask to prevent aspiration of the stomach contents. The mask must be replaced with nasal prongs while the patient eats and put back in place after he has finished the meal. Use the face mask, not the prongs, if the patient is unconscious or has an artificial airway.

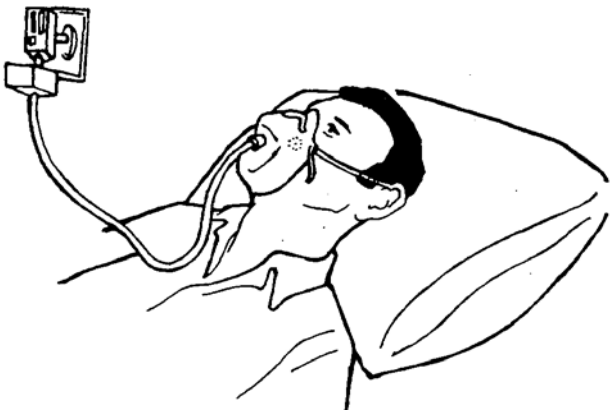


Figure 3-2. Oronasal face mask in use.

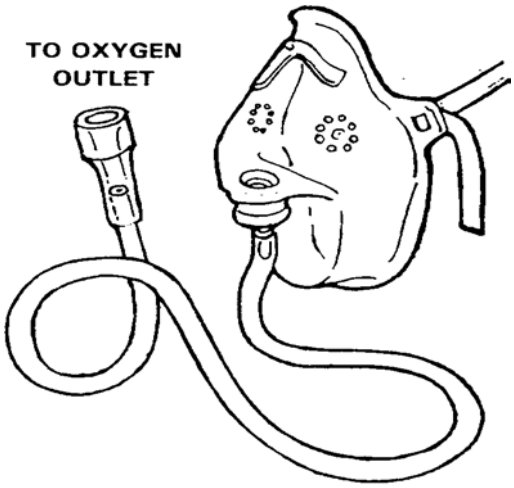


Figure 3-3. Close-up of face mask. (Note holes on the sides.)

3-5. PROCEDURE FOR SETTING UP AN OXYGEN TANK

The nasal prongs and the face mask require an oxygen source, usually from an oxygen tank or from piped-in oxygen. Most fixed-facility hospitals have piped-in oxygen. However, older hospitals and nonfixed facilities rely on oxygen tanks (figure 3-4) to deliver oxygen. If an oxygen tank is to be used, it must be properly prepared.

a. **Determine Need to Set up an Oxygen Tank.** In a hospital, you will set up an oxygen tank when required to do so by orders from the physician or supervisor or when required to do so by the standing operating procedures (SOP). In a field situation, the medic must use his own judgment in determining the need for oxygen.

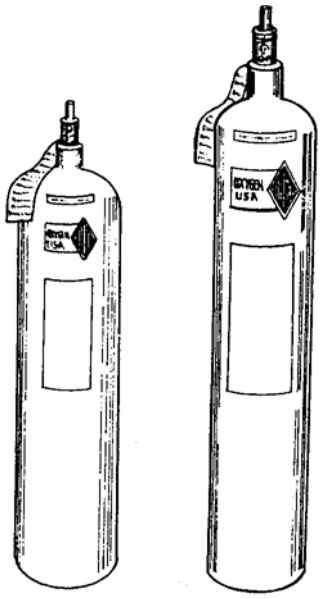


Figure 3-4. Oxygen (0_2) cylinders.

b. **Perform Handwash.** Follow procedures for performing a patient care handwash.

c. **Obtain Equipment.** Obtain the following equipment as needed.

(1) Full oxygen tank (cylinder). Oxygen tanks are usually kept in a central location designated by the hospital SOP.

(a) Oxygen tanks are color coded (painted) **green**; however, the international color code for oxygen is **white**.

(b) Tanks are available in various sizes, but the most commonly used tanks are D, E, and M cylinders. The "D" tank contains 356 liters of oxygen; the "E" contains 650 liters; and the "M" contains 3,000 liters. Each is filled to specified limits with a pressure of from 2,000 to 2,200 pounds per square inch (psi). As the oxygen is used, the pressure decreases. A tank is considered to be sufficiently pressurized for use as long as it maintains a pressure of 200 psi or greater.

(c) Check the tag on the oxygen cylinder. The oxygen cylinder tag is a three-part perforated design with the three sections labeled "Full," "In Use," and "Empty" (figure 3-5). The tag should have all three sections intact. When the cylinder is turned on for use by the patient, the "Full" segment is torn off. When the tank is empty, the "In Use" segment is removed, leaving the only the "Empty" portion of the tag. The tank is considered to be empty when the gauge reads 200 psi.

(2) Oxygen cylinder truck, if applicable. A transport designed for gas cylinders must be used when moving a large ("M") oxygen cylinder.

(3) Cylinder regulator. The cylinder regulator (figure 3-6) is used to control the flow of oxygen from the cylinder. The oxygen in the cylinder is under great pressure. By controlling the rate at which oxygen leaves the cylinder, the oxygen pressure is lowered to a pressure that is safe for the patient. The regulator ensures a steady, even flow of oxygen and provides a means for adjusting the rate of flow. The cylinder regulator has two gauges.

(a) The cylinder contents gauge shows the amount of oxygen in the cylinder and is calibrated in pounds of pressure per square inch (psi). When the tank is almost depleted (a pressure of 200 psi is considered to be "on empty"), the needle points to a red warning that the tank needs to be replaced.

(b) The second gauge, called a flow meter (or flow indicator gauge) shows the amount of oxygen being delivered and is calibrated in liters per minute. There are two main types of flow meters. One is the Bourdon gauge (round type) shown in figure 3-6. The other is the pressure compensated flow meter that works on gravity and must be kept upright. A pressure compensated flow meter is shown in figure 3-12.

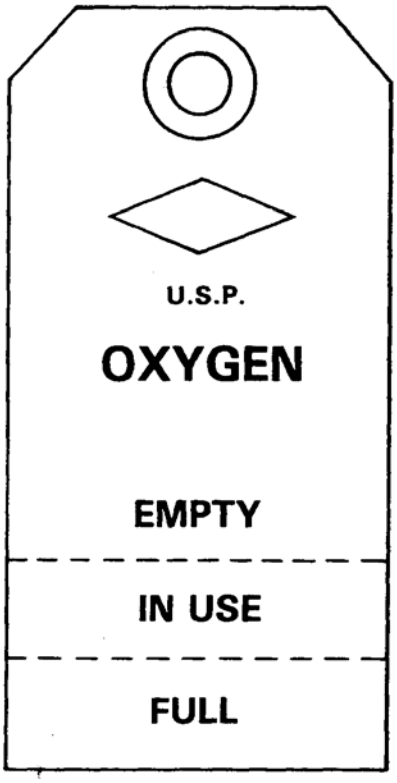
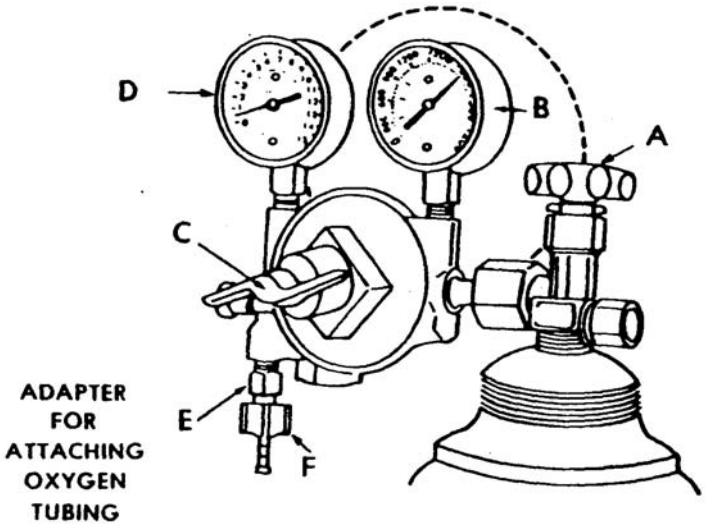


Figure 3-5. Cylinder tag.



A - CYLINDER VALVE
B - HIGH-PRESSURE GAUGE
C - FLOW-ADJUSTING HANDLE
D - RATE-OF-FLOW METER
E - CONNECTOR FOR HUMIDIFIER WING NUT ADAPTOR
F - WING NUT ON OXYGEN WING ADAPTOR

Figure 3-6. Cylinder regulator.

CAUTION: Because of the extreme pressure in these tanks, they should be handled with the utmost care and respect. If the tanks are violently banged together, dropped, or knocked over, the valve may be broken. A broken valve can cause the tank to become an uncontrolled torpedo-like object, destroying whatever is in its path.

(4) Humidifier. A humidifier (figure 3-7) is used to add moisture to the oxygen. This helps to prevent drying and irritation of the patient's mucous membranes during the administration of oxygen.

(5) Distilled water. One liter of distilled water is needed to fill and replenish the humidifier.

(6) Nonsparking cylinder wrench. Nonsparking wrenches (figure 3-8) are used to reduce the chance of a spark occurring in case the wrench hits against the metal cylinder. Nonsparking wrenches are usually made of brass. A nonsparking wrench is normally attached to the cylinder stand or carrier.

(7) Oxygen delivery system. An oxygen delivery device (nasal prongs or face mask) and tubing to connect the delivery device to the oxygen supply is needed. This is used per physician's orders or supervisor's directive.

(8) "No Smoking" signs. Three "No Smoking" signs are needed.

Figure 3-7. Humidifier.

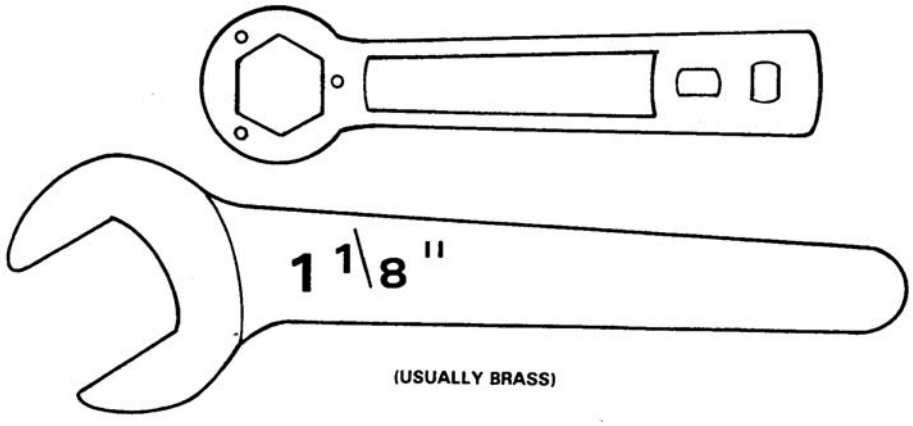


Figure 3-8. Nonsparking cylinder wrenches.

d. **Remove Cylinder Valve Cap.** All oxygen cylinders have a steel cap that is screwed onto the top of the cylinder to protect the valve from damage while the cylinder is not in use. The cap may be difficult to remove or noisy during removal. Do not oil the threads of the cylinder cap. Even though oxygen itself does not burn or explode, it does support combustion. In an oxygen-enriched atmosphere, a small spark can cause flammable objects (bed linen, and so forth) or flammable liquids (oil, and so forth) to burst into flames. Remove the cylinder valve cap by turning it counterclockwise with your hand.

e. **"Crack" the Cylinder.** "Crack" the cylinder by fitting a handwheel over the cylinder stem, quickly turning the cylinder handwheel counterclockwise to open the valve slightly, and immediately turning it back clockwise to close the valve (figure 3-9). The "cracking" procedure produces a loud hissing noise that can be frightening if not expected; therefore, it should be accomplished prior to moving the cylinder into the patient's room. "Cracking" the cylinder removes any dust particles that may have accumulated on the outlet.

(1) If the cylinder valve does not have a handwheel, fit a nonsparking cylinder wrench over the stem, turn counterclockwise, and immediately turn back clockwise to close the valve. "M" cylinders usually have handwheels; the smaller cylinders usually do not.

(2) If the cracking procedure does not result in a noisy rush of air through the valve, report the problem to your supervisor and obtain another cylinder.

f. **Move the Cylinder.** Move the cylinder into the patient's room at this time if so desired. However, you may wish to attach other devices before moving the cylinder. When the cylinder is taken to the patient area, put the cylinder beside the head of the bed away from doors, doorways, heaters, and areas that have heavy traffic.

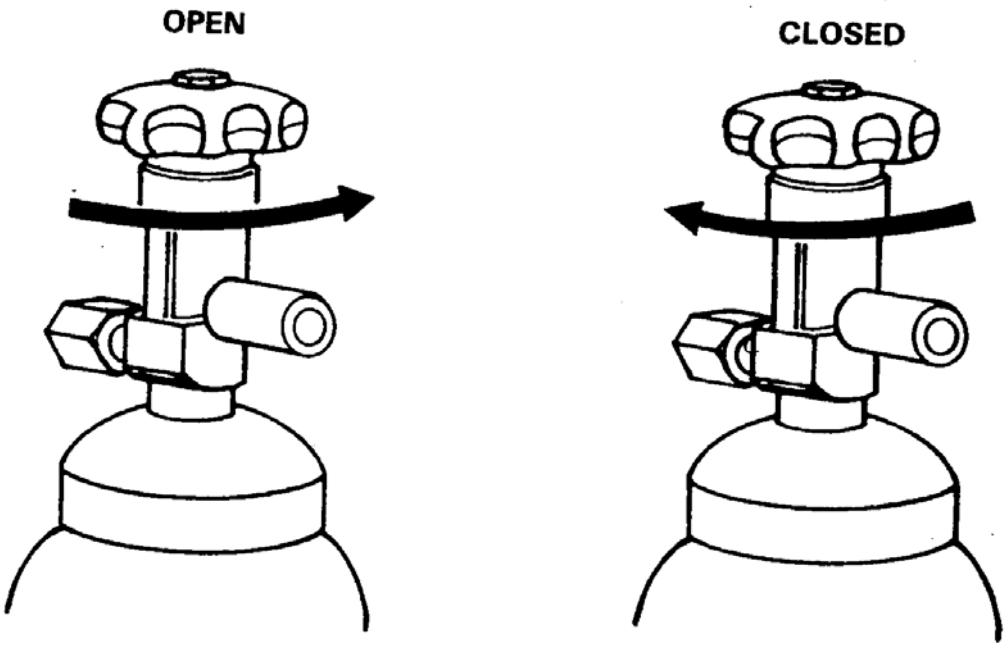


Figure 3-9. "Cracking" the cylinder.

g. **Attach the Cylinder Regulator.**

(1) "M" cylinder. To attach the cylinder regulator to the oxygen cylinder, hold the gauges in the upright position. Then insert the male portion of the cylinder regulator inlet into the threaded outlet on the oxygen cylinder (figure 3-10). Use your hand to tighten the inlet nut located on the cylinder regulator. Complete the tightening of the nut with a nonsparking wrench.

(2) "D and "E" cylinders. Attach the yoke regulator to the cylinder using the following procedures.

(a) Locate the three holes on the cylinder stem as shown in figure 3-11.

(b) Examine the yoke attachment and locate the three pegs that correspond to the holes on the cylinder stem (figure 3-11).

(c) Make sure that the "O" ring is present on the main peg of the attachment. If the ring is not present, an oxygen leak could develop.

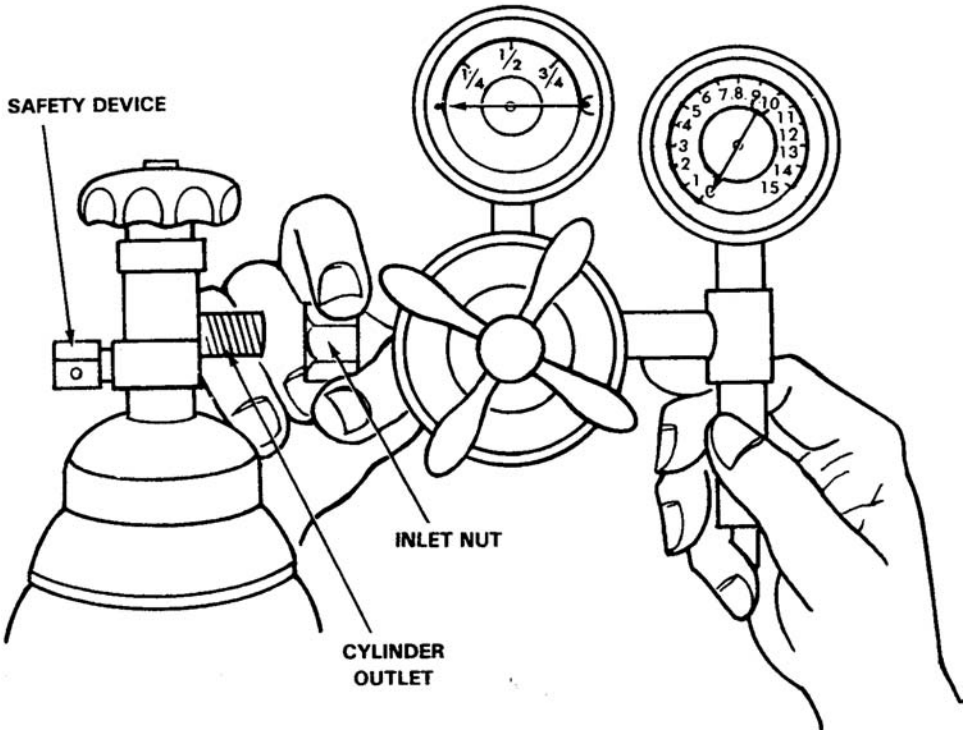


Figure 3-10. Attaching a cylinder regulator.

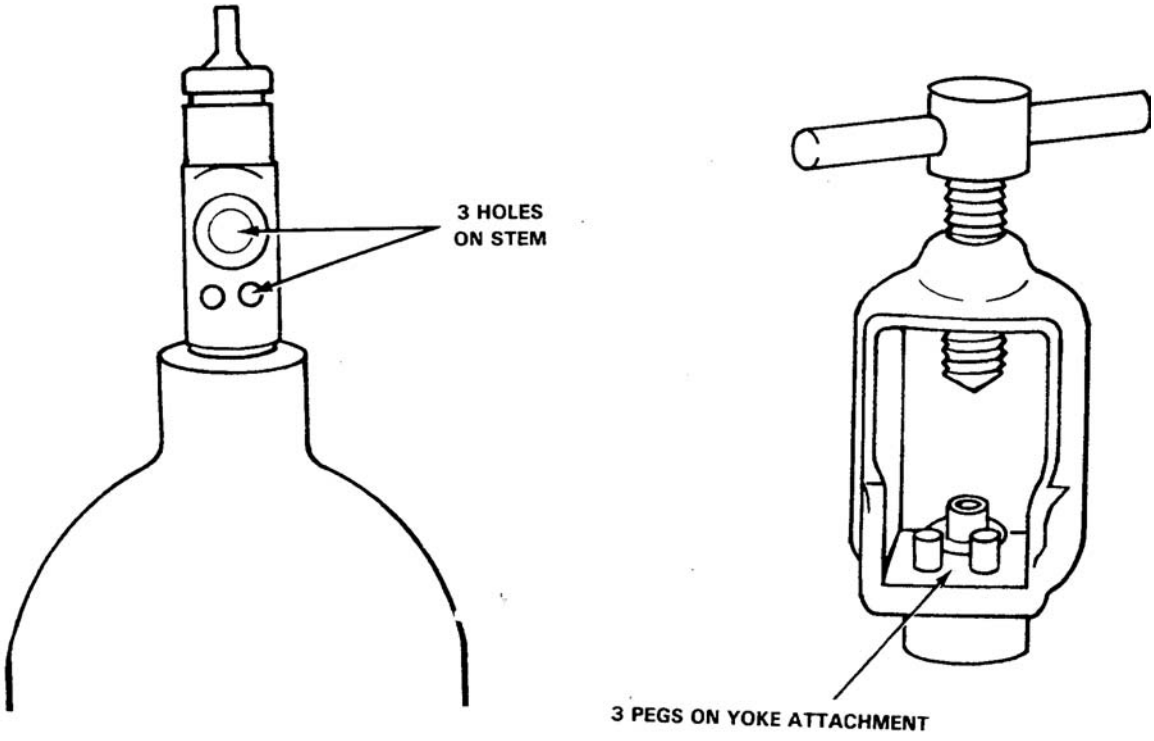


Figure 3-11. Cylinder stem and yoke attachment.

(d) Holding the yoke attachment firmly in both hands, slide it over the cylinder stem, making sure the pegs are correctly seated in the proper holes. The main peg connects with the oxygen valve. The two lower pegs must fit into the two smaller holes below the valve. The two lower holes are a safety precaution. Each type of gas container (oxygen, nitrous oxide, and so forth) has the lower holes located in different positions. The different hole locations prevent an oxygen delivery system from being connected to a non-oxygen cylinder.

(e) Turn the viselike screw on the slide of the yoke attachment to secure it.

h. **Fill the Humidifier.** Fill the humidifier bottle with distilled water so that the water level is between the marked minimum and maximum levels (approximately 2/3 full). Refill as necessary to maintain water level above the minimum mark.

(1) Because oxygen is very drying to the mucous membranes, it is bubbled through water to add humidity that makes it less irritating to tissues. Oxygen may be administered without humidification for short periods such as in emergency situations or during transportation.

(2) Bacterial growth on oxygen humidifiers may occur. Therefore, humidifiers and tubing should be changed at least every 24 hours or in accordance with local SOP.

i. **Attach the Humidifier to the Flow Meter.** Remove the oxygen tube connector from the flow meter by turning the wing nut. Attach the wing nut on the humidifier to the flow meter and secure by tightening the wing nut (figure 3-12).

j. **Attach the Administering Device.** Open the package containing the device to be used in administering the oxygen (nasal prongs or face mask) only far enough to expose the end of the connecting tube. Attach the end of the connecting tube to the oxygen outlet on the humidifier. The rest of the device should remain in the wrapper until ready for use to protect it from dust and contamination.

k. **Secure the Oxygen Cylinder.** Secure the cylinder in accordance with the local policy. Some facilities have special devices used to secure oxygen cylinders. Other facilities use straps to secure the cylinder to stable areas such as the bed or the wall.

l. **Post "No Smoking" Signs.** Place one "No Smoking" sign on the head of the patient's bed, one on the door to the patient's room, and one on the oxygen tank.

m. **Report the Setup Procedure.** Report the completion of the setup procedure to the supervisor.

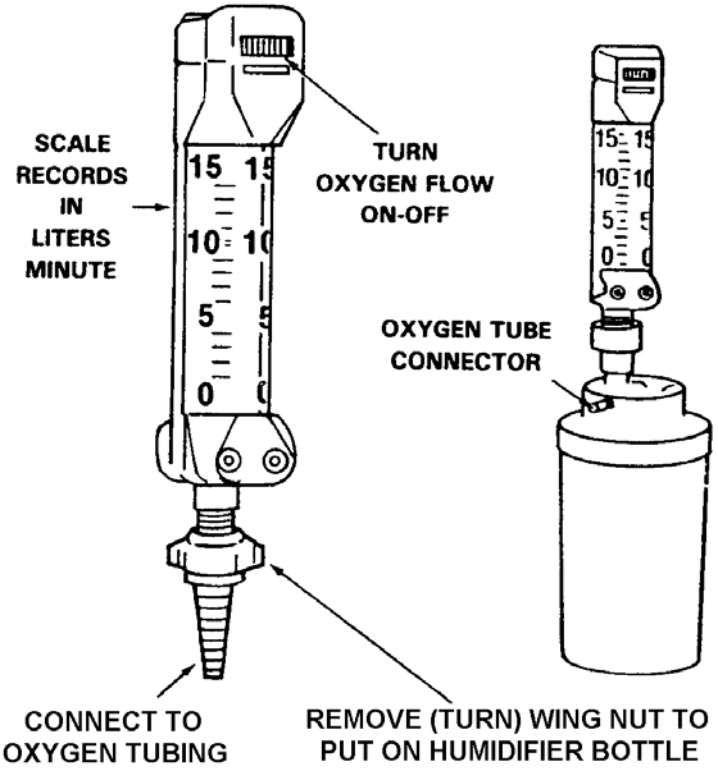


Figure 3-12. Attaching humidifier to flow meter.

3-6. PROCEDURE FOR SETTING UP A WALL OXYGEN UNIT

When oxygen is to be obtained from a piped-in supply, a station valve is located on the wall. Two general types of station outlet valves are currently in use. One is a manually operated valve with which the oxygen is turned on and off with a knob (figure 3-13). The other type is the "quick connect" coupler to which a flow meter can be connected simply by plugging it into the valve (figure 3-14). Other piping outlets, such as vacuum, may be located in the same area with the "quick connect" oxygen outlet. The wall outlet is keyed so that only oxygen equipment can be plugged into an oxygen valve and only vacuum equipment can be plugged into a vacuum valve. Oxygen outlets are color-coded **green** and vacuum outlets are color-coded **yellow**.

a. **Determine Requirement To Set Up Wall Oxygen Unit.** The requirement for the wall oxygen unit to be set up will normally be obtained from the physician's order or from your supervisor.

b. **Perform Handwash.** Follow the procedures for performing a patient care handwash.

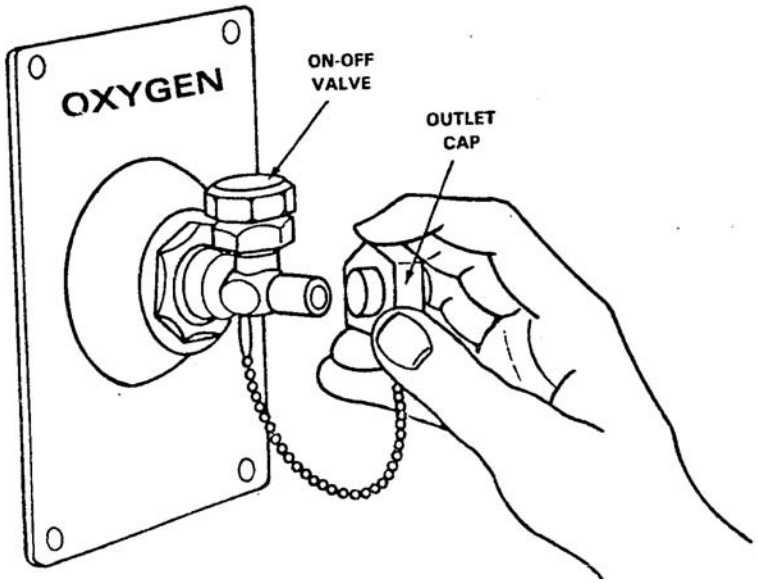


Figure 3-13. Manually operated valve.

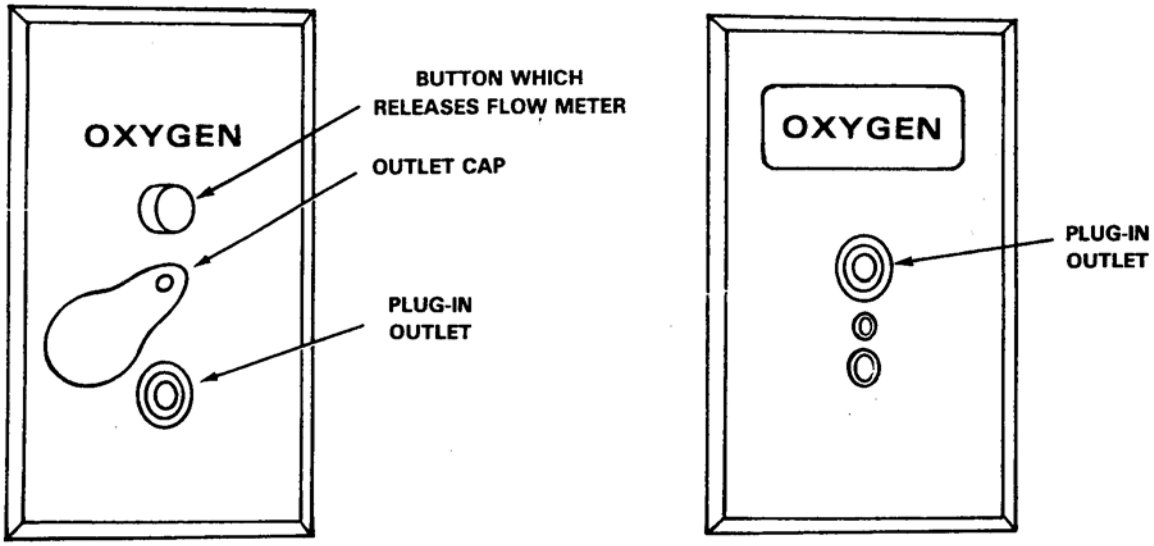


Figure 3-14. "Quick connect" couplers.

c. **Obtain Equipment.**

(1) Flow meter. Oxygen flows through the pipeline at a low pressure, usually 50-60 pounds per square inch. A flow meter (figure 3-15) must be attached to the wall outlet to control the flow of oxygen to the patient.

(2) Humidifier. The humidifier prevents drying and irritation of the patient's mucous membranes by adding moisture to the oxygen being inhaled.

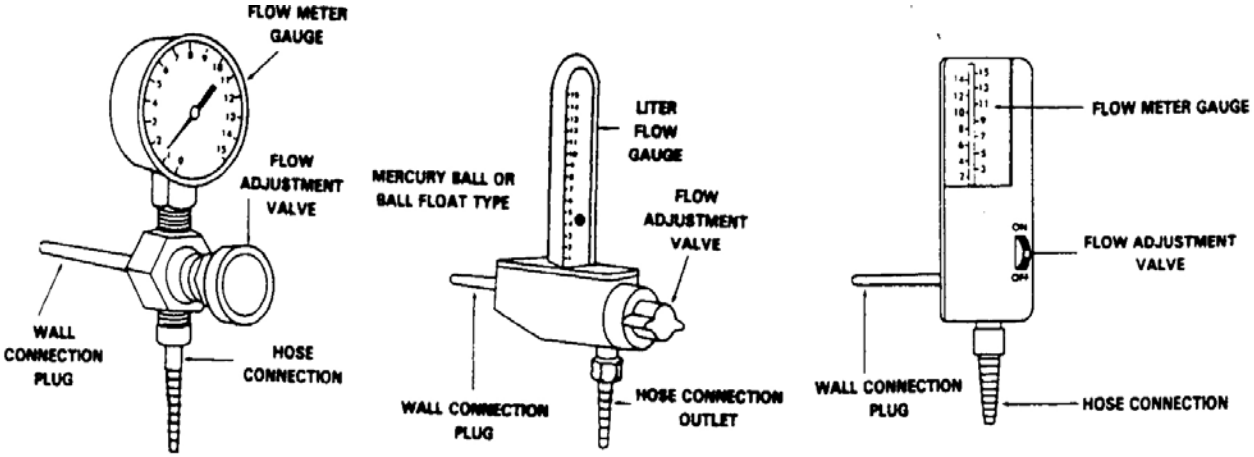


Figure 3-15. Flow meters for wall oxygen setups.

(3) Distilled water. One liter of distilled water will be needed for the humidifier.

(4) Delivery device. Obtain the packaged nasal prongs or face mask as per physician's order or supervisor's directive.

(5) "No Smoking" Signs. The signs are to be placed strategically on the head of the patient's bed, on the oxygen equipment, and on the patient's door.

d. **Fill Humidifier Bottle.** Fill the humidifier bottle to the level indicated (about 2/3 full) with distilled water. Refill as necessary to maintain the water level above the minimal level.

e. **Attach Humidifier to Flow Meter.** Remove the oxygen tube connector from the flow meter by turning the wing nut. Attach the wing nut on the humidifier to the flow meter outlet; then secure the wing nut to the flow meter.

f. **Attach Flow Meter to Wall Unit.** Close or turn the flow-adjusting valve of the flow meter to the "off" position. (Closing or turning the flow adjusting valve/dial to the "off" position will prevent damage to the gauge caused by a sudden influx of oxygen under pressure.) Insert the flow meter adapter into the opening of the oxygen outlet (figure 3-16) and press until a firm connection is made. You will hear a small "hiss" when the connection has been made.

g. **Attach Delivery Device.** Open the package of the device (nasal prongs or face mask) only far enough to expose the end of the connecting tube. Attach the end of the connecting tube to the oxygen outlet on the humidifier. After the connecting tube is attached to the humidifier outlet, leave the rest of the device in the wrapper until it is ready to be used. This will protect it from dust and contamination.

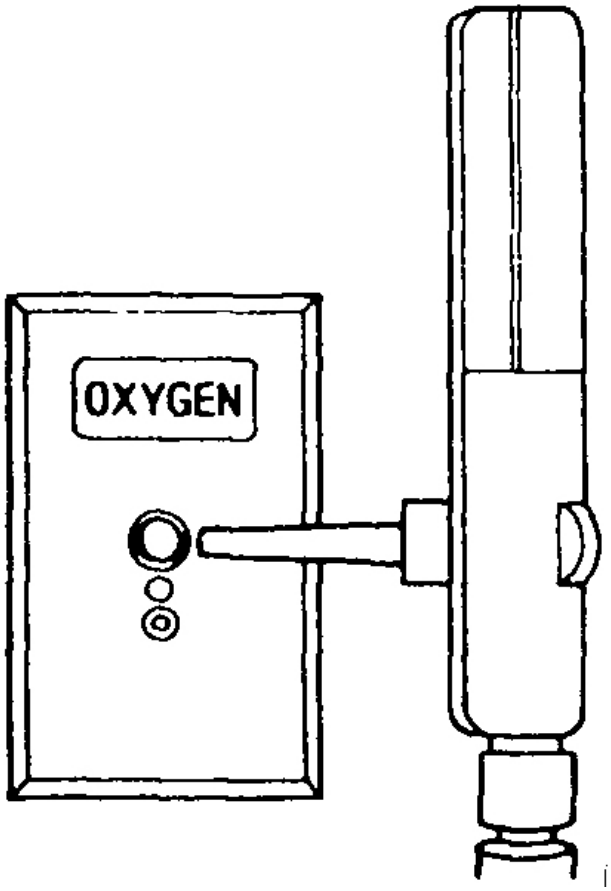


Figure 3-16. Attaching flow meter to "quick connect" coupler.

h. **Report to Supervisor.** Report the accomplishment of the procedure to the supervisor.

3-7. PROCEDURE FOR ADMINISTERING OXYGEN USING NASAL PRONGS OR FACE MASK

a. **Identify the Patient.** Determine the patient's name by asking his name and by checking his identification bracelet and bed card.

b. **Explain the Procedure to the Patient.** Show the nasal cannula or facemask to the patient and explain what is going to happen during the administration of oxygen.

c. **Prepare the Equipment for Administering Oxygen.** Post a "No Smoking" sign on the outside of the patient's door in view of other patients and visitors. Ensure that the humidifier is filled to the proper level. (If the humidifier is too full, the bubbling water will overflow into the gauges.) Attach the humidifier to the flow meter and attach the connecting tube from the nasal cannula or facemask to the humidifier (paragraphs 3-5 and 3-6). Set the flow rate at two liters per minute. Feel to determine if the oxygen is flowing through the nasal tips of the cannula.

d. **Calculate the Duration of Flow.** The duration of flow is the estimated amount of time that a given cylinder of oxygen will supply oxygen at a given rate. A safety factor (the safe residual) is built into the formula.

(1) Determine the pressure of the oxygen in the cylinder from the pressure gauge on the cylinder.

(2) Determine the safe residual level. The safe residual established by the American Academy of Orthopedic Surgeons is 200 psi. Your SOP, however, may establish a different safe residual. Replacing an oxygen cylinder when the safe residual level is reached ensures that enough oxygen is available should an emergency medical problem occur.

(3) Determine the available cylinder pressure by subtracting the safe residual from the cylinder pressure. For example, a cylinder with a pressure of 2000 psi has an available pressure of 1800 psi if the safe residual level is 200 psi (2000 - 200 = 1800 psi available pressure.)

(4) Determine the conversion factor. Each type of oxygen cylinder employs a conversion factor based upon its size. For example, the "D" cylinder authorized for use in battalion aid stations has a conversion factor of 0.16. The conversion factors are:

(a) "D" = 0.16

(b) "E" = 0.28

(c) "G" = 2.41

(d) "H" & "K" = 3.14

(e) "M" = 1.56

(5) Determine the available liters by multiplying the available pressure by the conversion factor. For example, a "D" oxygen cylinder with an available cylinder pressure of 1800 psi has 288 litters of available oxygen (1800 x 0.16 = 288). Remember that the available liters do not include the oxygen that is still left in the cylinder when the safe residual level is reached.

(6) Determine the flow rate. The flow rate is prescribed by the physician and expressed as liters per minute (lpm or l/m).

(7) Determine the duration of flow by dividing the available liters by the flow rate. For example, a cylinder with 288 available liters of oxygen that is to be administered at a rate of 10 lpm will reach the safety level and need to be replaced by a new cylinder after 29 minutes (288 / 10 = 28.8; fractions of a minutes are rounded up or down, as appropriate).

e. **Apply the Nasal Prongs or Face Mask.**

(1) Nasal prongs.

(a) Place the tips of the prongs in the patient's nose.

(b) Position the prongs so that the tips do not extend more than one inch (2.5 cm) into the nose.

(c) Adjust the flow rate to the prescribed rate. A flow rate of one to six liters per minute should provide an inspired oxygen concentration of 22 to 35 percent, depending on the patient's breathing pattern.

(d) Secure the headband or retaining strap so that it is comfortable for the patient and is sufficient to hold the apparatus in place.

(e) Fasten the tubing to the pillow and bed clothing. Ensure that the tubing is secure and is not kinked or crimped.

(2) Face mask. The patient who requires low, constant concentrations of oxygen and whose breathing pattern varies greatly may need to use the Venturi mask, especially if the patient is prone to retain carbon dioxide.

(a) Obtain the proper size mask.

(b) Before applying, hold the mask near the patient's face to show him how it and the retaining strap are to be placed.

(c) Start the oxygen at the prescribed rate. This is done prior to the placement of the mask since the patient may be less apprehensive if he hears the oxygen coming through the mask.

(d) Place the mask on the patient's face. Tell the patient to breathe naturally while you are adjusting the mask over his mouth and nose.

(e) Adjust the headband or retaining strap so that it is comfortable for the patient and holds the mask securely in place.

f. **Position Patient.** Place the patient in the semi-Fowler's position for ease of breathing.

g. **Record the Procedure on the Nursing Notes.** Record the time the treatment was initiated, the method used, the rate of flow, and the patient's response to treatment given.

h. **Manage the Patient and Equipment at Regular Intervals.**

(1) Observe the patient for mental confusion, for disturbed unconsciousness, and for abnormal color. Check for any change in the patient's blood pressure and for increasing heart and respiratory rates.

(2) Check the equipment. Make sure that the tubing connections are intact, the flow meter registers at the prescribed rate, and the nasal prongs or facemask is positioned properly. Check the water level in the humidifier and refill as needed. Change the cannula, humidifiers, tubing, and other equipment exposed to moisture on a daily basis. The equipment is changed daily because moisture can promote bacterial growth, thus rendering the equipment contaminated and creating conditions, which can cause infections.

3-8. SAFETY PRECAUTIONS ASSOCIATED WITH OXYGEN THERAPY

a. Post "Oxygen" and "No Smoking" signs. These signs should be posted on the cylinder in use, in oxygen storage areas, and at entrances to a ward or room where oxygen is in use. The chief danger in using oxygen is fire. The pressure of oxygen in increased concentrations makes all materials more combustible. Things that burn slowly in ordinary air will burn violently and even explosively in the presence of increased oxygen.

b. Inform the patient and visitors of the requirement for no smoking and no open flames in the room.

c. Ensure that oil or grease is not used around the oxygen fittings. (Petroleum-based products will burn.)

d. If an oxygen tank is used, secure it away from the door and high traffic areas to reduce potential unauthorized tampering of cylinder gauges and to reduce the possibility of the cylinder being knocked over and the valve being damaged or broken.

e. Use only nonsparking wrenches on tanks.

f. Ensure that all electrical equipment is properly grounded. If necessary, have medical maintenance personnel check electrical plugs and outlets.

g. Avoid static-generating materials. Avoid nylon or other static-generating materials in uniforms, nightgowns, and pajamas. Do not use wool blankets on the bed since they also produce static.

h. When transporting a large oxygen cylinder, strap it to the carrier. If the oxygen cylinder is not secured, it may drop or fall. Upon falling, the weight of the cylinder may injure personnel or patients and damage equipment, walls, and flooring. The valve could possibly break off from the cylinder creating a high velocity missile (the cylinder) because of the suddenly released high pressure. A full oxygen cylinder has enough force to penetrate concrete walls.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS. Answer the following items by completing the statement or by writing the answer in the space provided at the end of the item.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. What is hypoxemia?

   _____

2. How is hypoxemia treated?

   _____

3. Name two ways in which oxygen is normally supplied.

   _____

   _____

4. What is the United States color code for oxygen tanks? The international color code?

   _____ _____

5. How could the oxygen tank become an uncontrolled torpedo-like object?

   _____

6. Why is a cylinder regulator used when administering oxygen?

   _____

   _____

   _____

7. A flow meter (or flow indicator gauge) is calibrated in _____.

8. Why is the humidifier used when administering oxygen?

_____

_____

9. How do you "crack" the cylinder?

_____

_____

10. Humidifiers and tubing should be changed at least every 24 hours or in accordance with the local SOP because:

_____

_____

11. Vacuum outlets may be located in the same area with the oxygen outlet. Oxygen outlets are color coded _____ and vacuum outlets are color coded _____.

12. When you are attaching the flow meter to the wall unit (piped-in oxygen), why do you close or turn the flow adjusting valve of the flow meter to the OFF position?

_____

_____

13. Why must the facemask be used with caution?

_____

_____

14. What are the signs and symptoms of hyperventilation?

_____

_____

_____

_____

15. How would you treat a person who is hyperventilating?

_____

_____

_____

16. When do you replace the oxygen cylinder with one that is full?

_____

_____

17. The conversion factor for the "D" type cylinder is _____.

18. A "M" cylinder is at 2100 psi. The safe residual level is 200 psi the rate of flow is 9 l/m. What is the duration of flow?

_____

19. Position the nasal prongs in the patient's nose so that the tips do not extend more than _____ into the nose.

20. You are checking on a patient who is being administered oxygen. What are some of the danger signs that indicate a problem?

_____

_____

_____

_____

21. Use only _____ wrenches on oxygen tanks.

22. Inform the patient and visitors of the requirement for _____ and _____ in the room while oxygen is being administered.

23. During oxygen therapy, do not use _____ blankets on the patient's bed.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. A low level of oxygen in the blood. (para 3-2)

2. By administering extra oxygen. (para 3-2b)

3. Oxygen tank (cylinder).
   Wall outlets (piped-in oxygen). (para 3-2b(1))

4. U.S. color code is green; the international color is white. (para 3-5c(1)(a))

5. If the valve is broken. (para 3-5c(1) Caution)

6. Used to reduce the high pressure in the cylinder to a low pressure that is safe for the casualty. (para 3-5c(3))

7. Liters per minute. (para 3-5c(3)(b))

8. It is used to add moisture to the oxygen to prevent drying and irritation of the patient's mucous membranes. (para 3-5c(4))

9. By quickly turning the cylinder handwheel (or wrench if a handwheel is not available) counterclockwise to open it slightly, listening for a loud hiss of escaping oxygen, and immediately turning it back clockwise to close it. (para 3-5e)

10. bacterial growth may occur. (para 3-7h(2)

11. oxygen: green; vacuum: yellow. (para 3-6)

12. To prevent damage to the gauge caused by a sudden influx of oxygen under pressure. (para 3-6f)

13. Patient may vomit and be unable to remove the mask to prevent aspiration of the stomach contents. (para 3-4b)

14. Rapid and unusually deep breathing.
    Extreme anxiety and apprehension.
    Dizziness.
    Numbness of hands, fingers, toes, lips, and tongue.
    Healthy pink color to the skin.
    Stabbing chest pain.
    Flexed position of the hands with thumb curved toward the palms.
    Trembling and muscle cramping of the extremities. (para 3-3b(1)(a))

15. Reassure the casualty and encourage him to slow his breathing rate. Place a paper bag or other suitable item over his nose and mouth. Have him breathe into the bag and rebreathe the exhaled air, which has a high concentration of carbon dioxide. (para 3-3c(1)(b))

16. When the pressure gauge registers 200 psi (or the local SOP safe residual guideline). (paras 3-5c(1)(c), 3-7d(2))

17. 0.16. (para 3-7d(4)(a))

18. $\frac{\text{(Cylinder pressure--safe residual) x conversion factor}}{\text{flow rate}} =$

$\frac{(2100-200)(1.56)}{9} = \frac{1900 \times 1.56}{9} = \frac{2964}{9} = 329.3$ minutes or 5 hours 29 minutes

(para 3-7d)

19. 1 inch (2.5cm). (para 3-7e(1)(b)

20. Mental confusion.
Disturbed unconsciousness.
Abnormal color.
Change in blood pressure.
Increasing heart rate.
Increased respiratory rate. (para 3-7h(1))

21. Nonsparking (para 3-8e)

22. No smoking, no open flames. (para 3-8b)

23. Wool (or static-generating). para 3-8g)

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Oral, Nasopharyngeal, and Nasotracheal Suctioning.
LESSON ASSIGNMENT	Paragraphs 4-1 through 4-4.
LESSON OBJECTIVES	After completing this lesson, you will be able to:

4-1. State/identify the steps in the performance of oral suctioning.

4-2. State/identify the steps in the performance of nasopharyngeal suctioning.

4-3. State/identify the steps in the performance of nasotracheal suctioning.

4-4. State/identify possible complications, which can result from suctioning.

4-5. Identify when suctioning should be performed.

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

LESSON 4

ORAL, NASOPHARYNGEAL, AND NASOTRACHEAL SUCTIONING.

4-1. SUCTIONING

a. Suctioning is a common nursing activity performed for the purpose of removing accumulated secretions from the patient's nose, mouth, and/or tracheobronchial tree in order to maintain a patent (open) airway as well as to remove lung secretions that block gaseous exchange. Removal of these secretions can be carried out through the oropharyngeal (mouth and pharynx), nasopharyngeal (nose and pharynx), or nasotracheal (nose, pharynx, and trachea) routes. Artificial airways, such as an endotracheal tube (a tube inserted into the trachea through the nose or mouth) or a tracheostomy tube (a tube inserted through a surgical incision into the trachea), can also be used as routes for suctioning.

b. Suctioning is performed on patients who have lost control of their ability to swallow and to cough up secretions due to a stroke, unconsciousness, or disease process. The procedure should be performed ONLY when needed. Frequent suctioning causes trauma to the mucous linings of the respiratory tract and can result in hemorrhage and edema. Nasotracheal suctioning can also cause hypoxemia, infections in the lungs (pneumonia), atelectasis (collapsed lung), and cardiac arrest.

c. It is desirable to have the patient manage his own secretions. Postoperative patients must be turned and encouraged to cough and deep breathe frequently (usually every two hours) following surgery. This practice will be helpful in preventing postoperative complications such as pneumonia and reducing the need for suctioning.

d. When more than one route is used, either route may be performed first. Whenever the route is changed, however, the used catheter and gloves are discarded and a new catheter and new gloves are used for the new route. Sterile technique must be is used for all nasotracheal suctioning to prevent the introduction of "foreign" organisms (including numerous organisms normally found in the nose and pharynx) into the lungs.

4-2. PROCEDURES PERFORMED PRIOR TO SUCTIONING

a. **Verify Need for Suctioning.** The need for suctioning can be determined from the following sources.

(1) Physician's orders.

(2) Nursing Care Plan.

(3) The supervisor's directive.

(4) Local SOP.

(5) Personal observations. One or more of the following observations in a patient indicate a need for suctioning:

(a) Increased respirations accompanied by labored or difficult breathing.

(b) Moist, noisy, rattling, or gurgling sounds while breathing.

(c) Secretions drooling from the mouth and/or nose.

NOTE: The physician's orders, nursing care plan, or the supervisor's directive will dictate the frequency of suctioning, usually prn (as needed).

b. **Perform a Patient Care Handwash.** When suctioning, every effort must be made to prevent the introduction of pathogens into the lower airways. Clean technique and thorough handwashing are essential for suctioning of the oral and nasal cavities. Sterile technique is mandatory for deep suctioning in the tracheobronchial tree and suctioning through the endotracheal and tracheostomy tubes. Follow aseptic techniques for all suctioning of the airway in order to minimize the spread of microorganisms that are not normally found in the air passages.

c. **Obtain the Necessary Equipment.** Obtain the following equipment.

(1) Disposable suction equipment set. If such a set is not available, assemble the following:

(a) Sterile, disposable suction catheters. (Catheters are sized using the French scale: the smaller the number, the smaller the catheter. For example, 12 is smaller than 14 by this scale. These two catheter sizes are the most commonly used for suctioning the adult patient.)

(b) Liter flask of sterile saline or water.

(c) Sterile solution basin.

(d) Sterile gloves.

(2) Suction apparatus. Suctioning of the airway requires a source of vacuum. Most hospitals that have piped-in oxygen also have a piped-in vacuum source. When a piping system is not available, portable suction units must be used. Most portable suction used in hospitals units must be connected to an electrical source. Many portable units designed for field use, however, obtain their power from compressed gas (air, oxygen, or Freon) cylinders and do not need electrical power. Figure 4-1 shows two types of suction devices.

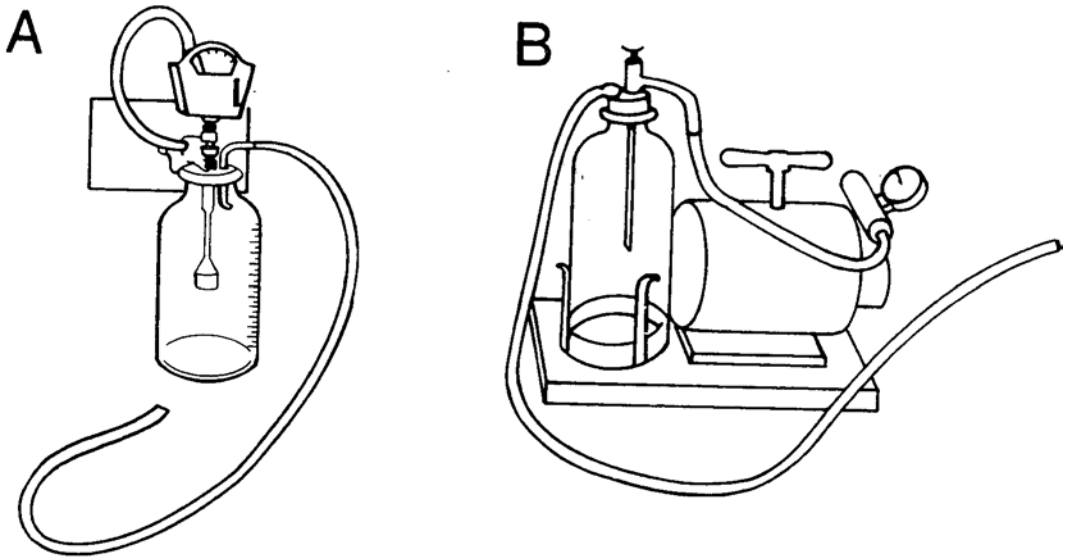


Figure 4-1. Suction apparatus. A Wall (fixed) unit. B Portable unit.

(3) "Y" connectors (if applicable). "Y" connectors/ adapters are needed if the suction catheters do not have suction ports.

d. **Identify the Patient**. When you have orders to suction a patient, verify the patient's identity to make sure that you perform the procedure on the correct patient.

(1) If the patient is conscious, ask him his name and check his bed card and hospital identification bracelet.

(2) If the patient is unconscious, check the name on the bed card and on the hospital identification bracelet. Make sure that the name is the same on the card and the band.

(3) In a field situation, check the patient's ID card or "dog tags."

e. **Explain the Procedure**. Explain the suctioning procedure to the patient to lessen his fears and gain his cooperation.

f. **Provide Privacy**. Place a screen or curtain around the patient's area or close the door if the patient is in a room.

g. **Position the Patient**. Place the patient in a semi-Fowler's position. This position is a semi-sitting position in which the patient manages secretions better and breathes easier. In some cases (such as spinal injuries), the patient will have to be suctioned without being moved.

h. **Check the Pressure on Suction Apparatus.**

(1) Turn on the suction apparatus.

(2) Place a thumb over the end of the suction tubing and observe the pressure gauge (figure 4-2).

(a) Suction pressure is usually expressed in inches (in) of mercury (Hg) on the portable unit and in millimeters (mm) of mercury (Hg) on the wall-mounted units. The recommended pressure settings for adult patients are 7 to 15 inches of Hg for the portable unit and 120 to 150 mm Hg for the wall-mounted unit.

(b) If the pressure is too low, the secretions cannot be removed. If the pressure is too high, the mucous lining may be forcibly torn away and pulled into the catheter openings.

(3) If the pressure is not within the recommended limits, notify the supervisor before continuing.

(4) Turn off the suction unit after the correct pressure has been verified.

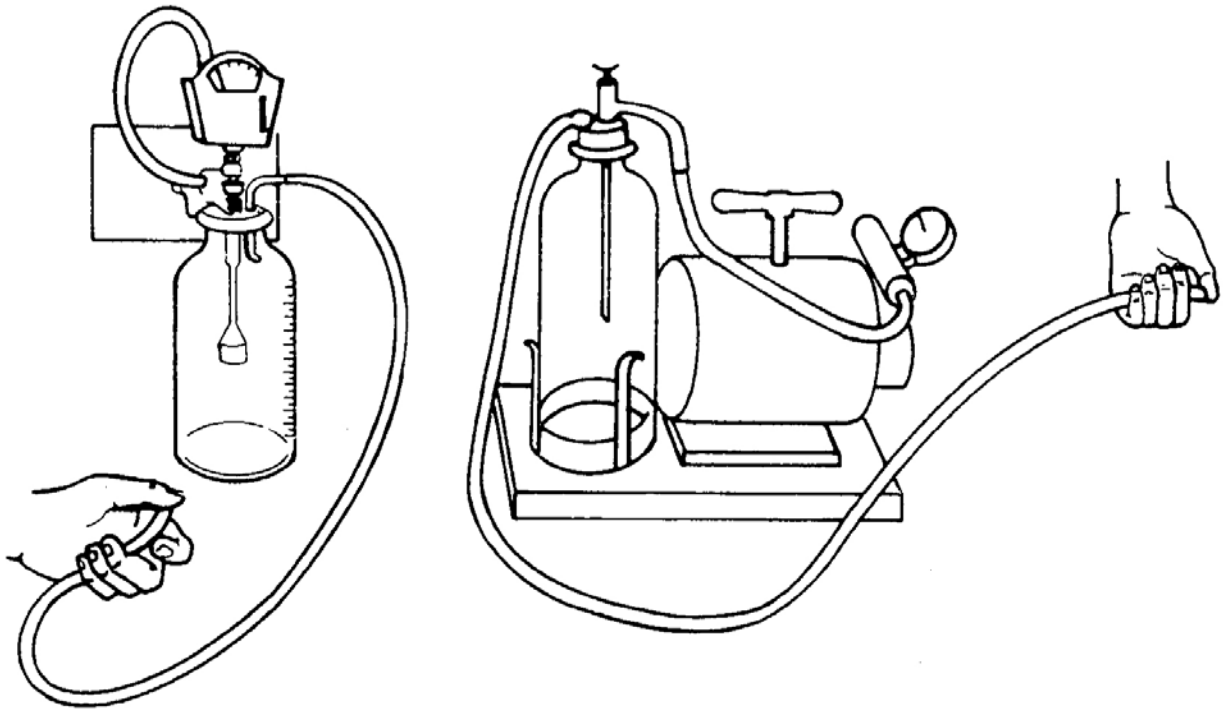


Figure 4-2. Checking pressure gauge of suctioning apparatus.

i. **Prepare Materials.** Open the disposable suction set (if used) or prepare materials for suctioning.

(1) Open the sterile solution basin on the bedside table.

(2) Pour the sterile solution into the solution basin without contaminating the solution, basin, or sterile field.

(3) Follow the package directions and open the suction catheter package to expose the suction part of the catheter.

(4) Open the sterile gloves package. In a disposable kit, the catheter and a sterile glove may be wrapped together. If the gloves are wrapped separately from the suction catheter, open the catheter package first.

j. **Oxygenate the Patient.** Provide additional oxygen for the patient prior to suctioning in order to prevent further hypoxemia (oxygen deficiency in the blood). Suctioning removes available air and oxygen as well as removing accumulated secretions.

(1) If the patient is on oxygen therapy, increase the percentage of oxygen to 100 percent for one minute.

(**NOTE**: If the patient has a respiratory disease, check with the supervisor before increasing oxygen.)

(2) If the patient is <u>not</u> on oxygen, have him take a minimum of five deep breaths.

(3) If the patient is unable to breathe on his own, administer five breaths with a BVM system.

k. **Put on Sterile Glove(s).**

(1) Some suction kits provide only one sterile glove. If only one sterile glove is available, put it on your dominant hand. Use the gloved hand to handle sterile items. The gloved hand must remain sterile throughout the procedure.

(2) If two sterile gloves are available, put one glove on your nondominate hand. Then put the remaining glove on your dominate hand. Your gloved dominate hand will be used to handle sterile items and must remain sterile throughout the procedure. The glove on the other hand provides protection to you and is used to handle nonsterile items.

l. **Remove Catheter From Package.** Remove the sterile catheter from the package with the sterile (dominant) hand. Keep the catheter coiled to prevent contamination.

m. **Attach Catheter to Suction Tubing.** Attach the suction catheter to the tubing from the suction apparatus (figure 4-3). When performing this step, hold the suction catheter in the gloved dominate hand and hold the tubing from the suction apparatus in the nonsterile (ungloved) hand.

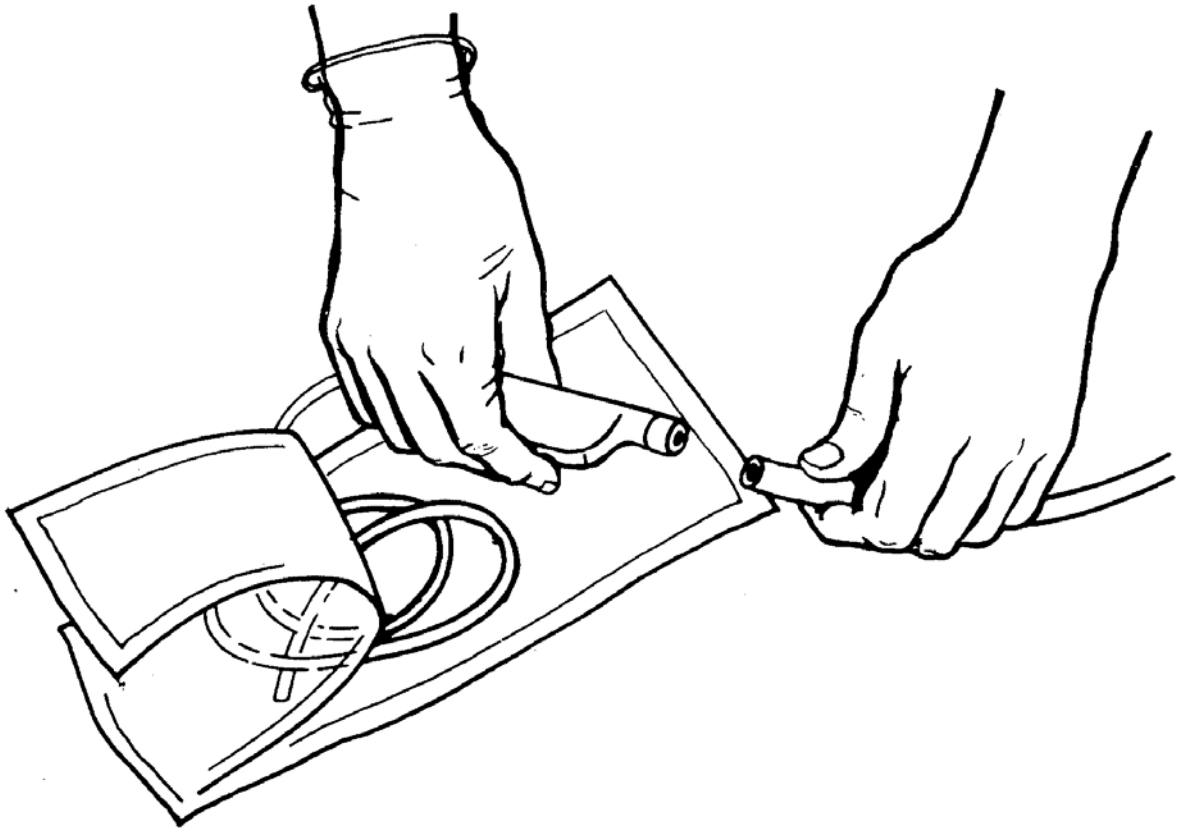


Figure 4-3. Connecting a catheter to suction apparatus.

n. **Test Patency of Catheter.**

(1) Turn the suction apparatus on with the nonsterile hand.

(2) Hold the catheter in the sterile hand and insert the tip in the basin of sterile solution.

(3) Place the thumb of the nonsterile hard over the suction port and observe the fluid entering the drainage bottle. If no fluid enters the drainage bottle, the catheter is blocked. If this occurs, obtain another catheter and repeat the procedure.

CAUTION: Do not leave the catheter in the solution. Even antibacterial solutions can promote the growth of certain types of bacteria.)

4-3. SUCTIONING THE PATIENT

Suctioning should not be continuous for more than 10 to 15 seconds. Suctioning removes oxygen as well as secretions; therefore, longer periods of continuous suctioning may result in an oxygen deprivation that is too severe for the patient.

NOTE: If you hold your breath during the suctioning period, you will be more aware of the oxygenation level of the patient.) Procedures for suctioning are given in the following paragraphs.

a. **Oral Route.** The oral route is normally used with an alert, cooperative patient.

(1) Tell the patient to cough. Coughing will help to bring up secretions to the back of the throat so they can be easily removed.

(2) Insert the tip of the catheter into the patient's mouth without using suction.

(a) Be aware that advancing the catheter too far into the back of the patient's throat may stimulate his gag reflex. This could lead to vomiting and aspiration of the stomach contents.

(b) If an oropharyngeal airway is in place, insert the catheter alongside the airway, then back into the pharynx.

(3) Apply suction by placing the thumb of the nonsterile hand over the suction port. Aspirate secretions from the back of the throat, along the outer gums and cheeks, and around the base of the tongue. Do not apply continuous suctioning for more than 10 to 15 seconds.

(4) Withdraw the catheter using a rotating motion. This prevents sucking mucous membrane tissue into the catheter.

(5) Clear the catheter by inserting the tip in the sterile solution and suction the solution through the catheter.

(6) Repeat these procedures until all secretions have been aspirated.

NOTE: Allow the patient to rest between suctionings and reoxygenate the patient before each suctioning.

(7) Discontinue suctioning when the patient's breathing efforts become less labored and difficult; and when the noisy, rattling, or gurgling sounds are no longer heard. In some patients, the complete absence of gurgling or rattling sounds cannot be achieved. If the sounds are still present after aspirations, notify the supervisor.

b. **Nasopharyngeal Route.** If the patient is uncooperative (clenches his teeth, bites, or chews the catheter), nasopharynx suctioning may be required to remove secretions from the back of the throat. This procedure is also used to remove secretions from the nose.

(1) Estimate the maximum distance the catheter is to be inserted. Do this by measuring from the tip of the patient's ear to his nose.

(2) Insert the suction catheter into one of the patient's nostrils without using suction.

(a) Generally, it is easier to insert a catheter into the right nostril than into the left, due to a lower incidence of septal deviation (a deformity of the wall separating the two nasal cavities, causing a partial or complete blockage of the nostril).

(b) If an obstruction is met, remove the catheter and try the left nostril.

(c) If an obstruction is still met, remove the catheter and obtain assistance from your supervisor or other appropriate personnel.

(3) Advance the catheter quickly and gently about 3 to 5 inches (but no more than the estimated maximum distance) into the nostril without using suction.

(4) Apply suction by placing the thumb of the nonsterile hand over the suction port. Suction for no more than 15 seconds

(5) Withdraw the catheter using a rotating motion. This prevents sucking mucous membrane tissue into the catheter.

(6) Clear the catheter by inserting the tip in the sterile solution and suction the solution through the catheter.

(7) Repeat these procedures until the secretions have been aspirated and a patent airway restored. Allow the patient to rest between suctionings and reoxygenate the patient before each suctioning.

c. **Nasotracheal Route.** Nasotracheal suctioning is similar to nasopharyngeal suctioning with deeper (trachea) suctioning being accomplished.

(1) Estimate the distance the catheter is to be inserted. Do this by measuring from the patient's nose to the tip of his ear, then to his larynx.

(2) Lubricate the tip of the catheter by dipping it into the basin of sterile solution.

(3) Instruct the alert, cooperative patient to flex his head and stick out the tongue. This helps to keep the patient from swallowing and makes the catheter insertion easier.

(4) Gently insert the suction catheter into the nasopharynx without suctioning. (Remember, it is usually easier to insert the catheter into the right nostril.) If the catheter cannot be inserted into the nasopharynx through either nostril, remove the catheter and obtain assistance from your supervisor or other appropriate personnel.

(5) Quickly and gently advance the catheter into the trachea (figure 4-4). The insertion process may cause the patient to cough. Mild coughing is usually not a problem and may actually help in the insertion process.

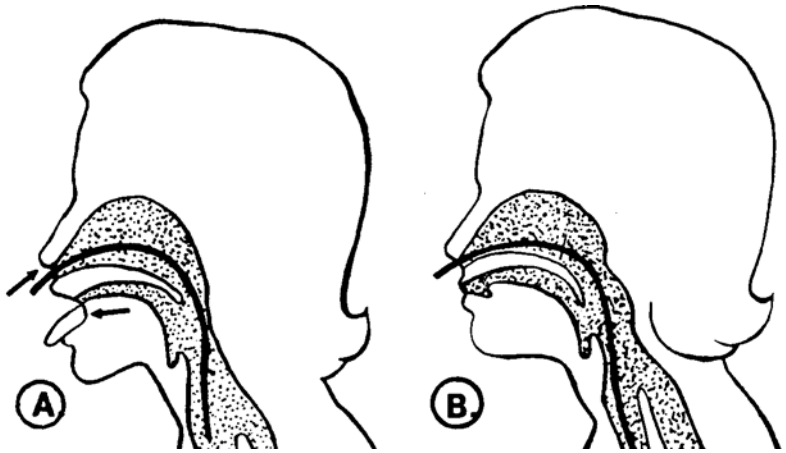


Figure 4-4. Inserting catheter using nasotracheal route.
A Patient sticking out tongue. B Insertion completed.

(6) Suction secretions by placing the thumb over the suction port. Suction the patient for approximately 15 seconds.

(7) Observe the patient throughout the procedure for color change or increased pulse rate. Pulse rate increases with hypoxemia. Listen for changing breath sounds. As secretions are removed, breathing should become quiet again. Discontinue suctioning if severe changes in color or pulse occurs.

(8) After suctioning, remove your thumb from the suction port and withdraw the catheter using a slow, rotating motion.

(9) Clear the catheter as required between suctionings. This is accomplished by inserting the tip of the catheter in the sterile solution, applying suction, and allowing the solution to run through the catheter until the catheter is clear of secretions.

(10) Repeat suctioning until all secretions have been aspirated. Allow the patient to rest between suctionings and reoxygenate the patient before each suctioning.

4-4. PROCEDURES PERFORMED AFTER SUCTIONING

a. **Remove Catheter and Glove.** After the suctioning is complete and the catheter has been removed, turn off the suction apparatus and disconnect the catheter from the suction tubing. Discard the catheter into the contaminated trash receptacle. Remove your glove(s) and discard into the contaminated trash receptacle.

b. **Make the Patient Comfortable.** Provide for the patient's comfort by straightening and tightening bed linens, placing the patient in the semi-Fowler's position, raising the bedside rails (if indicated), and placing the call bell/light within easy reach of the patient.

c. **Dispose of Used Items.** Discard other disposable items into the trash receptacle. Clean and store nondisposable items in accordance with the local SOP and replenish supplies as needed.

d. **Wash Hands.** Perform a patient care handwash.

e. **Record Procedure in the Nursing Notes.** Record the time, patient's respiration rate, description of respirations (labored, noisy, etc.), procedure used (oral, nasopharynx, or nasotracheal), and the type and amount of secretions obtained. If you cleared the catheter between suctionings, remember to subtract the amount of saline solution used from the total amount of fluid in the drainage bottle in order to arrive at the amount of secretions actually obtained.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTION. The following exercises are to be answered 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 the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. A common nursing activity performed to removing accumulated secretions from the patient's nose, mouth, and/or tracheo- bronchial tree is known as

   _____.

2. Name five complications which can be caused from nasotracheal suctioning:

   _____

   _____

   _____

   _____

   _____

3. What two sizes of catheters are most commonly used for suctioning adult patients?

   _____

4. Why is it important to explain the procedure to the patient?

   _____

   _____

5. The position in which the patient manages secretions better and breathes easier

   is known as the _____ position.

6. How can you check the pressure of the suctioning apparatus?

_____

7. What is the recommended suction pressure setting for adult patients?

   a. On the portable unit, it is _____.

   b. On the wall-mounted unit, it is_____.

8. If the pressure is not within the established limits, you should

_____

9. List the steps necessary to test the patency of the catheter.

_____

_____

_____

10. You are to perform an oral suctioning on a patient. The patient is uncooperative and clenches his teeth. What should you do?

_____

_____

_____

11. The patient on whom you are performing oral suctioning is alert and cooperative. What can he do to help?

_____

_____

12. How do you clear the catheter?

_____

_____

13. For nasotracheal suctioning, how do you measure the maximum distance the catheter is to be inserted?

_____

_____

14. Which nostril usually allows easier entry of the catheter?

_____

15. Observe the patient throughout the nasotracheal suctioning procedure for

_____ or

_____

16. You have two sizes of catheters available for nasotracheal suctioning--size 12 and size 14. You are told to use the larger of the two catheters. You should choose the:

    a. Size 12 catheter.

    b. Size 14 catheter.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. Suctioning. (para 4-1a)

2. Hemorrhage and edema.
   Hypoxemia.
   Infections in the lungs.
   Collapsed lung.
   Cardiac arrest. (para 4-2b)

3. Sizes 12 and 14 catheters. (para 4-2c(1)(a))

4. To lessen his fears and gain his cooperation. (para 4-2e)

5. Semi-Fowler's. (para 4-2g)

6. Place your thumb over the end of the suction tube and observe the pressure gauge. (para 4-2h(2))

7. a On the portable unit, it is 7 to 15 inches of Hg.
   b On the wall-mounted unit, it is 120 to 150 mm Hg. (para 4-2h(2)(a))

8. Notify the supervisor before continuing. (para 4-6h(3))

9. Turn on the suction apparatus with the ungloved hand. Hold the catheter in the gloved hand and insert the tip in a basin of sterile water. Place the thumb over the suction port and observe the saline entering the drainage bottle. (para 4-2n)

10. Insert the catheter into the patient's nose, without suction, 3 to 5 inches. Apply suction (no more than 15 seconds). Withdraw the catheter using a rotating motion. (para 4-3b)

11. Have him to cough and bring up secretions to the back of the throat so they can be easily removed. (para 4-3a(1))

12. Insert the tip in the sterile solution and suction the solution through the catheter. (para 4-3a(5)

13. Measure from the patient's nose to the tip of his ear, then to the larynx. (para 4-3c(1))

14. The patient's right nostril. (para 4-3c(3))

15. Color change or increased pulse rate. (para 4-3c(7))

16. b. (para 4-2c(1)(a))

End of Lesson 4