LESSON ASSIGNMENT

LESSON 2

Devices Used to Aid Breathing.

LESSON ASSIGNMENT

Paragraphs 2-1 through 2-10.

LESSON OBJECTIVES

After completing this lesson, you will be able to:

2-1. List/identify the steps used to insert a nasopharyngeal airway.

2-2. Identify when a nasopharyngeal airway should be used.

2-3. List/identify the steps used to insert an oropharyngeal airway.

2-4. Identify when an oropharyngeal airway should be used.

2-5 List/identify the steps used to insert a Combitube.

2-6 Identify when a Combitube should be used.

2-7 List/identify the steps used to perform a surgical cricothyrotomy.

2-8 Identify when a cricothyrotomy should be performed.

2-9. List/identify the steps used to ventilate a patient with a bag-valve-mask system.

2-10. Identify the procedures used to assist the patient's breathing.

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

2-1. NASOPHARYNGEAL AIRWAYS

a. Among the most critical skills the soldier medic must know are basic and advanced airway management. Without proper airway management techniques and oxygen administration, the patient may die needlessly. The soldier medic must be able to choose and effectively utilize the proper equipment for administering oxygen for both the medical and trauma casualty. The soldier medic must also keep in mind the principles of tactical casualty care and always do the appropriate intervention at the appropriate time.

b. 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, a nasopharyngeal airway, oropharyngeal airway, or Combitube airway may be needed to maintain an open air passage.

c. The nasopharyngeal airway (figure 2-1) is a flexible tube inserted through the external nasal passage and into the nasopharynx and oropharynx to elevate the tongue off of the back of the throat to maintain a patent airway. The insertion of this devise can be used with a conscious or unconscious patient; therefore it is the preferred airway during the tactical field care phase. It is also more effective than the oropharyngeal airway because it is less likely to be dislodged during movement of the patient during evacuation.

Figure 2-1. Nasopharyngeal airway.
2-2. PROCEDURE FOR INSERTING THE NASOPHARYNGEAL AIRWAY

a. Determine the Need for the Nasopharyngeal Airway. Before you insert the nasopharyngeal airway (NPA), you must assess the patient. This assessment should include checking for signs of facial trauma; this is a contraindication for the use of the nasopharyngeal airway. The assessment should also include determination of the casualty's mental status. Any casualty with an altered mental status should have their airway protected with a nasopharyngeal airway. Use the following indications and contraindications to help with determining the need for the nasopharyngeal airway.

(1) Indications.

(a) Casualty is conscious, semi-conscious, or has an active gag reflex.
(b) Casualty has injuries to mouth (for example, broken teeth, massive oral tissue damage).
(c) Seizure casualties who may have clenched teeth due to active seizing.
(d) When vomiting is likely to occur.

(2) Contraindications.

(a) Any evidence of a head injury or roof of mouth (cribriform) fracture; the airway may inadvertently enter the cranial vault with this type fracture.
(b) Exposed brain matter.
(c) Cerebrospinal fluid (CSF) draining from nose, mouth, or ears.

b. Determine the Proper Size Nasopharyngeal Airway.

(1) Diameter: Select an airway with a diameter smaller than the casualty's nostril or one that is approximately the diameter of the casualty's little finger.

(2) Length: Measure from the tip of the patient's nose to their ear lobe (figure 2-2).
NOTE: Most nasal pharyngeal airways are made to fit the right nostril. If you have to insert it into the left nostril, turn the airway upside down so that bevel remains toward the septum, then insert it straight back until you reach the posterior pharynx. Turn the airway 180 degrees until it lies behind the tongue.

c. Nasopharyngeal Insertion Procedures.

   (1) Place the casualty on a firm surface in the supine position with the cervical spine stabilized.

   (2) Lubricate the NPA with a water-soluble lubricant (or tap water if lubricant is not available).

   (3) Push the tip of the patient's nose slightly upward to expose the opening in the nostril.

   (4) Keeping the head in a neutral position, insert the tip of the NPA through the nostril.

   (5) Slowly advance tube along floor of nasal cavity with bevel pointing toward septum until flange rest firmly against casualty's nostril (figure 2-3).

      (a) If resistance is met during insertion, do not continue to insert.

      (b) Stop, remove the adjunct, relubricate, and try the other nostril.

      (c) If resistance is still met, check proper size or use alternate artificial airway method.
(6) Place the casualty in the recovery position if you cannot constantly monitor them.

(7) To remove the airway, pull out with a steady motion along the curvature of the nasal cavity.

Figure 2-3. Inserting the nasopharyngeal airway.

d. **Complications.**

(1) The most common complication is minor tissue trauma such as epistaxis (nosebleed); this, however, is not sufficient indication to remove the airway.

(2) The airway may trigger a gag reflex with some patients.

**2-3. OROPHARYNGEAL AIRWAYS (J-TUBES)**

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 this mechanical airway device is advised only when the patient is unconscious and does not have a gag reflex. Before inserting the airway, attempt normal resuscitation procedures manual airway procedures (the head-tilt chin-lift maneuver or jaw thrust maneuver).
2-4. 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.

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 2-5).
(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.

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 2-6).

   (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 2-7).
Figure 2-6. Tip of the oropharyngeal airway placed into the mouth.

Figure 2-7. 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 2-8).

(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. 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. This is why the oropharyngeal airway is not recommended in MASCAL and tactical situations when constant airway monitoring is not possible.

2-5. **COMBI-TUBE AIRWAYS**

a. The Combitube (figure 2-9) is an esophageal-tracheal double lumen airway. It is considered to be an intermediate airway whose abilities lie between the airway adjuncts oropharyngeal airway (OPA), nasopharyngeal airway (NPA), and an endotracheal intubation tube (ETT).

   b. The Combitube airway is designed to provide a patent airway for a respiratory/cardiac-arrested patient. The Combitube is a blind-insertion airway device (BIAD). It has been used successfully in patients with difficult airways secondary to severe facial burns, trauma, upper airway bleeding, and vomiting where there was an inability to directly visualize the vocal cords.
c. The Combitube can be used in patients whose cervical spine has been immobilized with a rigid cervical collar, though placement may be more difficult. Ventilation does not seem to be affected by the rigid cervical collar if the Combitube is emplaced.

d. The double lumen design allows for effective ventilations to be provided regardless of whether the tube is placed in the trachea or the esophagus.

e. The Combitube comes in two sizes: 37 French and 41 French.

2-6. PROCEDURES FOR INSERTING THE COMBI-TUBE AIRWAY

a. Indications.

(1) Adult patients in respiratory arrest.

(2) Adult patients in cardiac arrest.
b. **Contraindications.**

(1) Intact gag reflex.

(2) Patients less than 5 feet in height.

(3) Known esophageal disease.

(4) Caustic substance (acid or lye) ingestion.

c. **Side Effects and Complications.**

(1) An increased incidence of sore throat, dysphagia, and upper airway hematoma as compared to ETT.

(2) Esophageal rupture is a rare complication, but has been described.

(3) Complications may be partially preventable by avoiding over-inflation of the distal and proximal cuffs.

(4) Take appropriate BSI precautions, including facial protection, as vomiting can occur through the Number 2 tube if the initial placement is in the esophagus.

d. **Intubation Procedures.**

(1) Inspect the upper airway for visible obstruction.

(2) Hyperventilate (> 20/min) the patient for 30 seconds.

(3) Position patient’s head in a neutral position.

(4) Test both cuffs (white and blue) for leaks by inflating with 15 ml (white) or 100 ml (blue) of air.

(5) Insert the Combitube in the same direction as the natural curvature of the pharynx.

(a) Grasp the tongue and lower jaw between your thumb and index fingers and lift upward (jaw-lift maneuver).

(b) Insert the Combitube gently, but firmly, into the pharynx until the black rings on the tube are positioned between the patient’s teeth.
(c) Do not use force—if the tube does not insert easily, withdraw it and retry; hyperventilate the patient between each attempt.

(d) Inflate the Number 1 (blue) pilot balloon with 100 ml of air using a 100 ml syringe. Inflate the Number 2 (white) pilot balloon with 15 ml of air using a 20 ml syringe.

(e) Ventilate through the primary Number 1 (blue) tube. If auscultation of breath sounds is positive and auscultation of gastric sounds is negative, continue to ventilate.

(f) If auscultation of breath sounds is negative and gastric insufflation is positive, immediately begin ventilations through the shorter (white) Number 2 connecting tube. Confirm tracheal ventilation of breath sounds and absence of gastric insufflation.

(g) If auscultation of breath sounds and auscultation of gastric insufflation is negative, the Combitube may have been advanced too far into the pharynx. Deflate the Number 1 balloon/cuff and move the Combitube approximately 2 to 3 cm out of the patient's mouth.

(h) Re-inflate the Number 1 balloon with 100 ml of air and ventilate through the longer Number 1 connecting tube. If auscultation of breath sounds is positive and auscultation of gastric insufflation is negative, continue to ventilate.

(i) If breath sounds are still absent, immediately deflate both cuffs and extubate the patient.

(j) Insert oropharyngeal or nasopharyngeal airway and hyperventilate the patient with a bag-valve-mask (BVM) device.

e. **Combitube Removal Procedure.**

(1) The Combitube should not be removed unless:

(a) Tube placement cannot be determined.

(b) The patient no longer tolerates the tube (begins to gag).

(c) The patient vomits past either the distal or pharyngeal tube.

(d) There is a palpable pulse and the patient starts breathing on his own.

(e) A physician or physician assistant (PA) is present to place an ETT.
(2) Have suction equipment available and ready.

(3) Logroll the patient to the side, unless a spinal injury exists.

(4) Deflate the pharyngeal cuff using the Number 1 pilot balloon.

(5) Deflate the distal cuff using the Number 2 pilot balloon.

(6) Gently remove the Combitube while suctioning the airway.

2-7. SURGICAL AIRWAYS

   a. The establishment of an opening in the cricothyroid membrane is indicated for relief of life-threatening upper airway obstruction when:

      (1) Manual maneuvers (head-tilt-chin-lift, modified jaw-thrust) and attempts at ventilation have failed.

      (2) Endotracheal intubation is not feasible due to:

          (a) Unable to remove an upper airway foreign body airway obstruction (FBAO).

          (b) Laryngeal or glottic edema (anaphylaxis, burns, and so forth).

          (c) Maxillofacial trauma (distortion of landmarks).

          (d) Severe oropharyngeal hemorrhage.

   b. Although creating a surgical opening in the cricothyroid membrane is a very invasive procedure, its use may be necessary due to life threatening conditions. Inability to establish an airway due to obstruction or other complication creates a situation that requires quick thinking and rapid action. The surgical airway may be the only viable option in this critical time.

2-8. SURGICAL CRICOTHYROTOMY

   a. **Advantages.**

      (1) Rapid, relatively safe procedure.

      (2) Patient experiences noticeably less CO2 retention because of better ventilation.
b. Disadvantages.

(1) Requires some surgical skill and knowledge of anatomy.

(2) Only good for a relatively short time (24 to 48 hours).

c. Contraindications. A surgical cricothyroidotomy should not be performed on children under 12 years of age. In cases where standard airway maneuvers are unsuccessful, a less invasive needle cricothyroidotomy is indicated.

d. Complications of Cricothyroidotomy.

(1) Asphyxiation.

(2) Aspiration of blood or stomach contents.

(3) Cellulitis.

(4) Esophageal perforation or laceration.

(5) Incorrect placement (most commonly through the thyrohyoid membrane).

(6) False passage.

(7) Subcutaneous or mediastinal emphysema.

e. Equipment Needed.

(1) Body substance isolation (BSI).

(2) Antimicrobial solution.

(3) Local anesthetic (lidocaine 1 percent with epinephrine).

(4) Number 3 scalpel handle with a Number 10 blade (for skin) and a Number 11 blade (to incise the cricothyroid membrane).

(5) Hemostat (curved mosquito or curved Kelly).

(6) Oxygen source.
(7) Delivery device.

(a) Tracheostomy tube.

(b) Endotracheal tube. A modified ET tube (7.0 to 7.5 mm) will suffice. Simply remove the connector from the non-cuffed end and cut the tube just above where the inflation line enters the endotracheal tube and replace the connector. Do not cut the inflation line since this will prevent you from inflating the endotracheal cuff to help seal the airway.

f. Procedure.

(1) Place the patient in the supine position with the neck moderately hyperextended.

(2) Identify the landmarks. Palpate the "V" notch just above the thyroid cartilage (Adam's apple), which feels like a high, sharp bump. Stabilize the larynx between your thumb and middle fingers while you palpate the site with your index finger. Once you have located the "V" notch, slide your index finger down into the depression between the thyroid and cricoid cartilages; this is the cricothyroid membrane.

(3) Prepare the area with an antimicrobial solution and infiltrate the site with the anesthetic (if time will permit). Utilize a sterile field if available.

(4) Stabilize the larynx and thyroid cartilage with your non-dominant hand.

(5) Make a 2 to 3 cm longitudinal skin incision directly over the cricothyroid membrane (mid-sagittal); carefully incise through the membrane (see figure 2-10).

Figure 2-10. Cricothyroid membrane.
(6) Dilate the opening by inserting the blunt end of the scalpel handle into the incision and rotate it 90 degrees to open the airway. Alternately, a hemostat may be used in place of the scalpel handle. You can also use a manufactured or improvised hook device to hold the membrane open as you prepare for the next step in the process.

(7) Insert the cuffed endotracheal tube cut down to just above the pilot balloon into the cricothyroid membrane incision, directing the tube down the trachea approximately 4.5 mm in a caudal direction. Inflate the cuff with approximately 6 to 10 ml of air.

(8) Immediately ventilate the patient and auscultate all lung fields and over the epigastrum. Confirm (symmetrical) rise and fall of the chest. It should be noted that manually-triggered flow-restricted, oxygen-powered ventilation devices (FROPVD) should not be used in conjunction with any of these devices.

(9) Secure the tube with tracheal ties passed around the neck or with tape.

REMEMBER: ASSESS--TREAT--REASSESS

2-9. 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 non-return 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.

2-10. 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 2-11) so that the mask will fit the patient.

Figure 2-11. 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 2-12), 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 2-12. 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 2-13).

Figure 2-13. 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 2-13).

   (1) Squeeze two breaths lasting about 1 second each into 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 about twelve breaths per minute.

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

   (4) A reservoir bag should be used with the BVM to help obtain nearly 100 percent oxygen concentration.

**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.

*Continue with Exercises*

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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?

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

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

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

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6. List the contraindications for the use of the nasopharyngeal airway.

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______________________________________________________________

7. What are the advantages of the surgical cricothyrotomy?

______________________________________________________________

______________________________________________________________


Check Your Answers on Next Page
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 2-4d)

2. When the patient starts to regain consciousness, or gags. (para 2-4e)

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 2-4d(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 2-4d(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 2-10d, e).

6. Any evidence of a head injury or roof of mouth (cribriform) fracture. Exposed brain matter. CSF draining from nose, mouth or ears. (para 2-2(2), (a), (b), (c))

7. Rapid, relatively safe procedure. Patient experiences noticeably less CO₂ retention because of better ventilation. (para 2-8a(1), (2))

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