

Figure 9-3 Anatomy of the lower airway.

eventually branching into many smaller bronchioles and end in the alveoli, where gases are exchanged in the lung. For more information about the airway, review the appropriate section in Chapter 6, *Anatomy and Physiology*.

Respiration, or breathing, is a biological process in which air enters the body and then is expelled back into the environment. Oxygen in the air enters the lungs, and carbon dioxide, a waste product, leaves the lungs. The conduit through which gas enters and exits the lungs is the airway. Breathing is a mechanical process, both active and passive in nature, consisting of two phases: **inhalation** and **exhalation**. Both phases are controlled by the nervous system and occur automatically.

Inhalation, also known as inspiration, is an active process during which the respiratory muscles contract, creating negative internal pressure in the chest cavity thereby causing air to flow inward. Exhalation, or expiration, is the passive phase of respiration. During this phase, the respiratory muscles relax, increasing pressure within the chest, thereby expelling any unused air and gaseous waste products from the lungs and out of the body. For more detailed information about the mechanics of breathing, refer again to Chapter 6.

If breathing is compromised and oxygen cannot get into the blood through the lungs, respiratory distress is observed. Respiratory failure follows if this situation is not quickly corrected.

Airway Management

Airway management is the physical process that ensures the airway is open and clear. When the airway is closed, respiration cannot occur.

The airway must be immediately opened to prevent injury or death. Numerous methods and tools are used to manage a partially or completely occluded airway. By learn-

STOP, THINK, UNDERSTAND

Multiple Choice

Choose the correct answer.

- The purpose of the nasopharynx is to _____.
 - prevent food from entering the trachea.
 - remove noxious gases from inhaled air.
 - warm and humidify air as it enters the body and to remove small particles.
 - prevent air from entering the stomach.
- The purpose of the larynx is to _____.
 - generate sound when we speak.
 - warm and humidify air as it enters the body.
 - prevent food from entering the trachea.
 - prevent air from entering the esophagus.
- Which of the following is *not* true regarding inhalation?
 - It is controlled by the nervous system and occurs automatically.
 - It is an active process during which respiratory muscles contract.
 - Positive internal pressure in the chest cavity permits air to flow inward.
 - All of the above are correct.
- Which of the following is *not* true about expiration?
 - It is controlled by the nervous system and occurs automatically.
 - It is the active phase of respiration.
 - During this phase the respiratory muscles relax, increasing air pressure within the chest and causing unused gaseous waste products to be removed (exhaled) from the lungs.
 - All of the above are true.

is not moved and remains in an anatomically neutral position, because any neck movement could result in spinal injury. To perform the jaw-thrust maneuver, take the following steps:

1. Kneel down above the patient's head, with your knees straddling the head. (You can use your knees to gently stabilize the head and cervical spine.)
2. Using the fingers of both hands, grasp the angle of the mandible on each side of the jaw.
3. Place your thumbs on the mandible.
4. Lift the mandible upward.

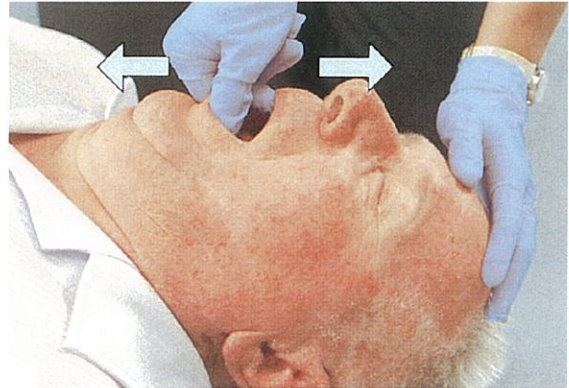


Figure 9-7 Opening a patient's mouth using the crossed-finger technique.

Opening the Mouth Using the Crossed-Finger Method

If you need to open a patient's mouth—to suction the oropharynx, to perform a finger sweep, or to insert an oral airway—the method most commonly used is the crossed-finger technique (Figure 9-7■). Always use Standard Precautions. To open the patient's mouth using this technique:

1. Using your dominant hand, cross your index finger under your thumb.
2. Place your thumb and index finger against the patient's upper and lower teeth. (Be careful not to insert either finger between the patient's teeth.)
3. Spread your thumb and finger apart to open the patient's mouth.

Clearing the Airway

Effective breathing is difficult when any foreign material obstructs the airway. The airway-opening techniques just described keep the tongue from blocking the airway, but they are not effective in clearing other obstructions such as blood, mucus, fluids, broken teeth, foreign bodies, dirt, and food. Debris must be cleared quickly to ensure adequate oxygen flow and prevent aspiration of fluid or solids into the lungs. OEC Technicians can remove mechanical obstructions from the airway by three means: using gravity, a finger sweep, or suction.

Gravity

Gravity is a time-honored method for quickly removing fluid and solids from the airway, and it requires no special equipment. This technique can be effective regardless of whether the patient is responsive or unresponsive. If the patient is responsive and is able to follow simple commands, instruct the person to lean forward with the head down (in a dependent position) to allow vomit, blood, and any solids to flow or fall out of the mouth or nose. If the patient is unresponsive, roll the person into the recovery position (discussed shortly). In the presence of a suspected spinal injury, the patient may be rolled onto his side while another rescuer maintains the patient's head and neck in a neutral position.

Finger Sweep

Occasionally, vomit, unchewed food, or other objects can become trapped in the airway; if not removed, the airway can become obstructed. If gravity is not effective in removing these objects, it may be necessary to clear the airway using the finger sweep technique (Figure 9-8■). This technique is indicated only for patients

9-3 Describe how to clear a patient's airway using the following methods:

- a. Gravity
- b. Finger sweep
- c. Suction

Figure 9-8 The use of a finger sweep to remove foreign objects.





Figure 9-12 The modified recovery position (or left lateral recumbent position) may be used to prevent aspiration in patients not suspected to have spinal injuries.

- + 9-4** Describe how to place a patient into the recovery position.

- + 9-6** List the indications of and uses for the following airway adjuncts, and demonstrate the proper methods of choosing the correct size and inserting them:
- Oropharyngeal airway
 - Nasopharyngeal airway

adjunct a medical device that is used to assist the OEC Technician in providing patient care.

nasopharyngeal airway

(NPA) a trumpet-shaped airway adjunct made from soft rubber or silicone that is inserted into the nostril to maintain a patent airway.

operated, replace or recharge the batteries as necessary to ensure satisfactory performance when the device is next used. If the suction unit is manually powered, replace the catheter-collection assembly. Always put disposable medical equipment in a biohazard container to dispose of it properly. See OEC Skill 9-1■.

Keeping the Airway Open and Clear

Recovery Position

Once the airway is opened and cleared, it must remain in this state to ensure adequate breathing. The easiest method to

achieve this, until other airway equipment or rescue personnel are available, is to place the patient into the HAINES (High Arm In Endangered Spine) recovery position (Figure 9-12■). This position, also known as the coma or left lateral recumbent position, is indicated for any unresponsive patient in whom spine injury is *not* suspected. It also may be used for responsive patients and any patients with an altered level of responsiveness who cannot manage their airway. When alone, rescuers should use this technique to allow them to do other care-related tasks. To place a patient into the recovery position, perform the following procedure:

1. Kneel by the left side of the patient, preferably with your knees near the patient's hips or chest.
2. Extend the patient's left arm so that it extends over the person's head.
3. Gently roll the patient toward you onto his left side so that his head rests on his straightened arm.
4. The head should be tilted at a *slight* downward angle, with the mouth open, to allow secretions to flow out of the mouth.
5. Flex the patient's right knee at a right angle to anchor the patient into this position.
6. Position the patient's right arm so that it is in front of the patient and does not block the rescuer's access to the patient's airway.
7. Always make sure the airway remains open.

Airway Adjuncts

Sometimes it is necessary to insert an airway **adjunct** in order to keep the airway open. The OEC Technician has two options—a nasopharyngeal airway or an oropharyngeal airway (Table 9-1■). One of these devices may be used depending on the patient's level of responsiveness.

Nasopharyngeal Airway A **nasopharyngeal airway (NPA)** is a flexible tube that is inserted into the nasopharynx (Figure 9-13■). It is made of soft, latex-free plastic. Also

Table 9-1 A Comparison of Oropharyngeal and Nasopharyngeal Airway Adjuncts

Oropharyngeal Airway (OPA)	Nasopharyngeal Airway (NPA)
Relieves airway obstruction caused by tongue	Relieves airway obstruction caused by the tongue or by mucus and nasal swelling
Relatively easy to insert	Easy to insert
Must not be used in a responsive patient or a person with an intact gag reflex	Can be safely used in responsive and semi-responsive patients or in a person with an intact gag reflex
Can be placed in patients who have nasal trauma	Caution required if used in patients who have oral trauma

STOP, THINK, UNDERSTAND

Multiple Choice

Choose the correct answer.

- Which of the following is *not* true about airway management?
 - It is a physical process that ensures that the airway is open and clear.
 - Respiration cannot occur through a closed or blocked (occluded) airway.
 - It is a fundamental and crucial life-saving skill that OEC Technicians must learn.
 - True airway maintenance is beyond the scope of OEC Technicians.
- Which of the following is a method for opening the airway?
 - head-tilt, chin-lift maneuver
 - crossed-finger maneuver
 - jaw-thrust maneuver
 - both A and C
- Which of the following is not correct regarding suctioning of an airway? (check all that apply)
 - Insert the catheter into the airway with the suction *on* (thumb hole covered).
 - Insert the catheter only as deeply as you can see.
 - Suction side to side for 10–15 seconds maximum in an adult, for 5–10 seconds maximum in a child.
 - Insert the catheter tip into the airway with the suction *off* (thumb hole open).
 - Suction only the outer nares and lips, allowing gravity to clear the remainder of the oropharynx and nasopharynx.
 - Suctioning is not a skill that OEC Technicians may perform.
- What can cause an airway to occlude and prevent adequate breathing? (check all that apply)
 - the tongue falling back into the pharynx
 - unnatural flexion, extension, or tilting of the patient's head
 - an inhaled foreign object such as food or a small toy
 - blood or vomitus
 - broken teeth
- Which of the following methods may be used to remove fluid and solids (such as vomitus or broken teeth) from a *responsive* patient's mouth? (check all that apply)
 - placing the patient sitting forward with the head in a dependent position
 - placing the patient in the recovery position with or without spinal precautions, as indicated
 - using suction with a rigid or flexible catheter
- Which of the following methods may be used to remove fluids or solids from an *unresponsive* patient's mouth? (check all that apply)
 - using a finger sweep
 - placing the patient in the recovery position with or without spinal precautions, as indicated
 - using suction with a rigid or flexible catheter

known as a nasal trumpet, this mechanical airway provides an unobstructed pathway from an external nares to the posterior nasopharynx, keeping the passageway open for air exchange. When properly sized, the adjunct is well tolerated, even in responsive patients, as it does not stimulate the gag reflex. NPAs come in a variety of sizes and can be used in all patients, from small children to large adults.

The indications for an NPA are fairly broad and include any patient in whom a mechanical airway is needed to keep the airway open. Indications include patients who

- ✦ are unresponsive or semi-responsive,
- ✦ have altered mental status and an intact gag reflex,
- ✦ exhibit signs of partial airway obstruction (as when snoring),
- ✦ have oral injuries and airway compromise, or
- ✦ have had, or are having, a seizure and whose teeth are tightly clenched.

The adjunct is relatively contraindicated in patients with massive head injuries due to possible aggravation of the injury and/or damage to the nose.

Proper insertion of an NPA consists of the following four steps, which can be remembered using the acronym “SLIC” (OEC Skill 9-2■).

Figure 9-13 Two nasopharyngeal (nasal) airways (NPAs).





CASE UPDATE



An assistant immediately performs a jaw-thrust maneuver to open the unresponsive patient's airway. As the assistant protects the patient's spine, you carefully roll the patient onto his side to allow blood to flow out of the airway. Noting several broken teeth in the patient's airway, you perform a finger sweep to remove the debris. Upon arrival of a suction device, you suction out the airway. Although the patient's pulse is strong, his respirations are becoming increasingly shallow and erratic. His lips are cyanotic.

What should you do now?

An OPA should be left in place until one of two conditions arises: either the patient begins to gag, or a more-advanced airway adjunct (Chapter 36) is inserted by an ALS provider. However, in the event that you need to remove an OPA, grasp the adjunct by the flanges and pull it both outward and slightly downward, following the natural contour of the tongue. Removal should be performed in one swift motion to reduce the incidence of vomiting and other complications. Have a suction device ready in case the patient vomits.

9-10 Describe and demonstrate how to use the following oxygen delivery, ventilation, and barrier devices:

- Nasal cannula
- Nonrebreather mask
- Pocket mask
- Bag-valve mask
- Face shield

Barrier Devices

OEC Technicians are sometimes the first rescuers to arrive at an incident, but they may not always have immediate access to certain medical equipment. Accordingly, be prepared for such contingencies by always carrying a few key items—including disposable medical gloves and a barrier device in the event you need to provide rescue breaths (Appendix C: Survival Kit).

Barrier devices are a form of personal protective equipment that provides a non-porous layer between you and the patient to prevent the transmission of communicable diseases (Figure 9-15). Used properly, a barrier device is an effective way to ventilate a patient until more sophisticated airway equipment and oxygen become available.

Barrier devices permit OEC Technicians to provide rescue breaths using the residual oxygen in the rescuer's lungs. The mixture of gases in exhaled air contains approximately 15–16 percent oxygen, which is enough to provide effective oxygenation to a patient who is not breathing. Room air is 21 percent oxygen. The use of a barrier device will help to ensure Standard Precautions are maintained. The most common barrier devices used for this purpose are a face shield and a pocket mask.

Face Shield A face shield is a clear plastic sheet, usually rectangular in shape, with a mouthpiece through which to administer rescue breaths. Some face shields also have an integrated one-way valve/bite block that directs air flow into the patient's airway while preventing the rescuer from becoming contaminated. To use a face shield, perform the following procedure:

- Kneel at either side of the patient's head.
- Remove the face shield from its protective package and place the shield over the patient's mouth and nose. If the device contains an integrated one-way valve/bite-block, place the valve into the patient's mouth, between the teeth.

Figure 9-15 Examples of barrier devices.



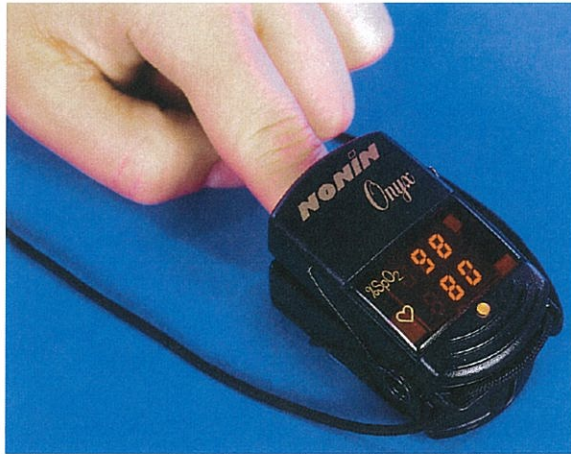


Figure 9-26c A mini “finger-sized” pulse oximeter.

air or oxygen to be directed down the esophagus and into the stomach. Partial or total obstruction of the upper airway also can cause gastric distention to occur. The condition is more common in children than in adults but can be prevented by administering slow, gentle breaths or by squeezing the bag over two full seconds.

Gastric distention is not without complications. It can cause vomiting or more-injurious aspiration of gastric contents into the lungs. In addition, gastric distention can restrict movement of the diaphragm, which can decrease the effectiveness of ventilations.

If the stomach becomes distended, make sure the airway is open. Do not push on a distended stomach because the result is nearly always vomiting, which can lead to aspiration of the vomit. If the patient does vomit, place the patient on his side, suction the airway, and then resume rescue breathing.

STOP, THINK, UNDERSTAND

Multiple Choice

Choose the correct answer.

- Pulse oximetry provides rescuers with what data? _____
 - hematocrit level
 - patient's respiratory rate
 - absolute data to determine whether or not oxygen administration is needed
 - quantitative data regarding the effectiveness of a patient's ventilatory efforts
- Under normal conditions and when breathing ambient air, in what range should a healthy individual's pulse oximetry level fall? _____
 - 72–80 percent
 - 82–90 percent
 - 95–100 percent
 - OEC Technicians cannot rely on pulse oximetry levels due to the adverse environment in which these parameters are usually measured.
- Which of the following statements about gastric distension is true? _____
 - It can be caused by artificial ventilations.
 - It is caused when ventilatory pressure exceeds the pressure holding the opening of the esophagus closed.
 - It is more common in children than adults.
 - All of the above are true.

Fill in the Blank

- The three oxygen delivery adjuncts are _____, _____, and _____.
- Some of the factors that can cause false pulse oximetry readings are _____.

+ CASE DISPOSITION +

You insert an OPA and begin providing artificial respirations using a pocket mask. As other providers and equipment arrive, you request that another OEC Technician assist you in two-man ventilation using a BVM, and you suction the patient as needed. You assist the team in immobilizing the patient's head and spine and placing him onto a toboggan. His arm was splinted. He is then transported to a waiting ambulance. You later learn that the patient had a severe head injury. The neurosurgeon who treated the patient credits you and your team for your effective airway management, without which, she states, the patient would have died.

You call for a toboggan, a backboard, the trauma pack, and an ALS unit. The requested help arrives. The patient's airway is patent, and she is breathing at 8 breaths per minute and shallow. You decide to insert an OPA to secure the airway.

2. How should you measure for the correct size of the oropharyngeal airway? _____
- from the bottom of the ear to the middle of the mouth
 - from the bottom of the ear to the tip of the nose
 - from the bottom of the ear to the corner of the mouth
 - from the center of the ear to the center of the mouth

The toboggan and trauma pack now arrive. When attempting to insert the OPA, you are prepared for vomiting and have the manual suction pump assembled and at the patient's side. As the OPA is inserted, the patient presents with a gag reflex.

3. Your response to the gag reflex is to _____
- remove the OPA and suction any vomitus material.
 - remove the OPA and attempt to reinsert a smaller size.
 - place the patient in the left lateral recumbent position.
 - place the patient in a prone position.

You remove the OPA, and the team uses a bag-valve mask with high-flow oxygen to assist the patient's breathing at a rate of one breath every five seconds.

You decide an NPA is the adjunct of choice, and using a water-soluble lubricant you insert the device with the bevel toward the septum in the larger nostril.

4. Before insertion, the NPA is measured _____
- from the earlobe to the edge of the mouth.
 - from the top of the ear to the middle of the nostril.
 - from middle of the ear to the middle of the nostril.
 - from the tip of the nose to the patient's earlobe.

EXPLORE



Please go to www.myNSPkit.com. Under Student Resources, you will find animations, videos, web links, and games related to this chapter—and much more. Look for information on controlling a nose bleed, oxygen administration, use of a nasal cannula, and use of a pocket mask.

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