

## Pre-Lecture

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### I. You Are the EMT

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Time: 10 Minutes

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Small Group Activity/Discussion

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Use this activity to motivate students to learn knowledge and skills needed to effectively manage a patient's airway.

#### Purpose

To allow students an opportunity to explore the significance of and concerns associated with managing a patient's airway.

#### Instructor Directions

1. Direct students to read the "You Are the EMT" scenario found in the beginning of Chapter 7.
2. You may assign students to a partner or a group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions.
3. You may also assign this as an individual activity and ask students to turn in their comments on a separate piece of paper.

## Lecture

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### I. Airway

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Time: 5 Minutes

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Slides: 1-11

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Lecture/Discussion

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A. The single most important step in caring for any patient is to make sure that he or she can breathe.

B. Inadequate breathing means impaired oxygen delivery to body tissues and cells.

C. Within seconds of being deprived of oxygen, the heart may not beat normally.

D. After 4 to 6 minutes without oxygen, the brain may be severely or permanently damaged.

#### E. Anatomy review

1. The upper airway consists of the nose, mouth, throat, and epiglottis.
2. The epiglottis prevents food from entering the trachea.
3. The lower airway consists of the larynx, trachea, bronchi, and alveoli.
4. The alveoli are where the exchange of oxygen and carbon dioxide takes place.
5. The diaphragm is the inferior boundary of the thorax and functions in ventilation.

#### F. Breathing process: inhalation

1. Active part of breathing

2. Contraction of the diaphragm and intercostal muscles increases the size of the thoracic cage, allowing the lungs to expand.
3. Negative pressure within the thoracic cage causes air to enter through the nose or mouth and into the lungs until the pressure equalizes.
4. Air moves to the alveoli where the exchange of gases occurs.

### G. Breathing process: exhalation

1. Does not normally require muscular effort
2. Diaphragm and intercostal muscles relax.
3. Thorax decreases in size, allowing the ribs and muscles to assume their normal position.
4. Increase in pressure forces air out.

### H. Physiology of the respiratory system

1. The body's need for oxygen
  - a. Each cell in the body needs oxygen delivered and wastes eliminated.
  - b. Some tissues may last hours without oxygen delivery.
  - c. Cardiac and brain cells are very susceptible to damage without a constant supply of oxygen.
2. Gas exchange
  - a. Diffusion is the movement of gas from a higher concentration to lower concentration.
  - b. During inhalation, oxygen-rich air is delivered to alveoli.
  - c. Oxygen diffuses into the blood.
  - d. Inhaled air contains approximately 21% oxygen.
  - e. Exhaled air contains approximately 16% oxygen.
  - f. The brain stem controls breathing.
  - g. Breathing is adjusted by the level of carbon dioxide in the blood.

## II. Hypoxia

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Time: 10 Minutes

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Slides: 12-13

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Lecture/Discussion

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- A. Dangerous condition in which the body's tissues and cells do not have enough oxygen
- B. Develops quickly in patients who are not breathing adequately or who are unable to move enough air into the lungs with each breath
- C. Onset and degree of tissue damage depends on the quality of the respirations
- D. General signs and symptoms
  1. Early signs
    - a. Mental status changes
    - b. Nervousness
    - c. Irritability
    - d. Apprehension
    - e. Tachycardia
    - f. Fear
  2. Use of accessory muscles for breathing
  3. Difficulty breathing

4. Possible chest pain
5. Cyanosis (late sign)

### E. Conditions commonly associated with hypoxia

1. Myocardial infarction (heart attack)
2. Pulmonary edema (fluid accumulation in lungs)
3. Acute narcotic overdose (resulting in respiratory depression)
4. Inhalation of smoke and/or toxic fumes (pulmonary edema and destruction of lung tissue)
5. Stroke (cerebrovascular accident or brain attack) (poor control of respiration and heart rate)
6. Chest injury (damage to lung and poor chest expansion due to pain)
7. Shock (hypoperfusion) (loss of red blood cells)
8. Chronic obstructive pulmonary disease (COPD) (damage to alveoli)
9. Asthma (narrow respiratory passages and buildup of mucus)

## III. Patient Assessment

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Time: 10 Minutes

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Slides: 14-16

Lecture/Discussion

DOT Ref 2-1-I-A-10-c

DOT Ref 2-1-I-A-10-d

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Table 7-1: Normal Respiration Rates

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### A. Recognizing adequate breathing

1. Characteristics of normal or adequate breathing
  - a. Normal rate and depth (12 to 20 breaths/min in adults)
  - b. Regular pattern of inhalation and exhalation
  - c. Clear and equal lungs sounds on both sides of the chest
  - d. Regular and equal chest rise and fall (chest expansion)
  - e. Adequate depth (tidal volume)
2. Normal respiratory rates
  - a. Adults—12 to 20 breaths/min
  - b. Children—15 to 30 breaths/min
  - c. Infants—25 to 30 breaths/min

### B. Recognizing inadequate breathing

1. A patient with inadequate breathing may appear to be working hard to breathe.
2. Labored breathing requires effort, especially in children, and may involve the accessory muscles of the neck, chest, and abdomen. Signs of inadequate breathing include:
  - a. Use of accessory muscles
  - b. Cyanotic skin
  - c. Cool, damp skin
  - d. Irregular respirations
  - e. Lungs sounds that are decreased, unequal, or “wet”
  - f. Shallow or uneven chest rise and fall
3. Agonal respirations (slow, shallow, gasping) are not adequate and always require ventilation assistance.
4. Some irregular breathing patterns are related to a specific condition.

- a. Cheyne-Stokes respirations are often seen in patients who have had a stroke with head injuries. They are characterized by an irregular pattern of increasing rate and depth, followed by a period of apnea.
  - b. Central neurogenic hyperventilation is characterized by rapid, deep respirations.
5. Emergency medical care includes airway management, supplemental oxygen, and ventilatory support.

## IV. Positioning Patients for BLS and CPR

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Time: 10 Minutes

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Slides: 17-19

Lecture/Discussion

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Note: This material may be a review for those students who have completed their basic CPR training. Monitor and modify lecture as needed.

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- A. Initial assessment should indicate whether breathing problems are present.
- B. If breathing is absent, begin immediate treatment with BLS measures.
- C. Indications of successful treatment
  - 1. Regular rise and fall of the chest with each ventilation
  - 2. Regular rate of ventilations
  - 3. Resumption of the regular heart rate
- D. Repositioning an unconscious adult patient who needs airway management and has a suspected cervical spine injury requires more than one rescuer.
  - 1. The first EMT-B kneels beside the patient while the second EMT-B kneels at the head.
  - 2. The first EMT-B straightens the patient's legs and moves the nearer arm across the patient's chest.
  - 3. The second EMT-B places his or her hands behind the back of the patient's head and neck to maintain the cervical spine.
  - 4. The first EMT-B turns the patient by pulling on the distant shoulder and hip.
  - 5. The second EMT-B controls the head and neck so that they move as a unit with the rest of the torso.
  - 6. The first EMT-B moves the patient's farther arm back to his or her side.
  - 7. If possible, log roll the patient onto a long spine board.
  - 8. Open the airway and assess breathing.

## V. Opening the Airway

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Time: 30 Minutes

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Slide: 20

Lecture/Discussion

DOT Ref 2-1-11-A

DOT Ref 2-1-11-B

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Note: This material may be a review for those students who have completed their basic CPR training. Monitor and modify lecture as needed.

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- A. Emergency medical care begins with ensuring an open airway.
- B. Initial assessment should indicate whether breathing problems are present.
- C. Appropriate patient care cannot be given unless the airway is open.
- D. Patient needs to be in a supine position.

E. In an unconscious patient, the most common airway obstruction is the tongue, which falls back into the throat when the muscles of the throat and tongue relax.

1. Dentures, blood, vomit, mucus, food, or other foreign objects may also create a blockage.
2. Always have a suction device available.
3. Facial trauma is a big challenge, because it can result in severe tissue swelling and bleeding into the airway.

F. Head tilt-chin lift maneuver is one way to open an airway.

1. Use this maneuver for patients who have not sustained trauma.
  - a. Kneel beside the supine patient.
  - b. Place one hand on the patient's forehead and apply backward pressure.
  - c. Place the tips of the fingers of the other hand under the lower jaw.
  - d. Lift the chin.
2. Remove loose dentures.

G. Jaw-thrust maneuver is another way to open an airway.

1. Use for patients with suspected spinal injury.
  - a. Kneel above the patient's head with your fingers behind the angle of the jaw.
  - b. Move the jaw.
  - c. Use your thumbs to open the patient's mouth.
  - d. For trauma patients, keep the head in a neutral position.

H. After the airway is open, reassess the patient.

1. Patients may start to breathe on their own.
2. Assess whether breathing has returned.
  - a. Listen by placing your ear about 1 □ above the patient's nose and mouth.
  - b. Feel and listen for movement of air.
  - c. Watch the patient's chest and abdomen.
  - d. Place a hand on the patient's chest to feel movement.

## VI. Basic Airway Adjuncts

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Time: 30 Minutes

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Slides: 21-26

Lecture/Discussion

DOT Ref 2-1-V

DOT Ref 2-1-V-A

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DOT Ref 2-1-V-B

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A. The principal purposes of airway adjuncts are to prevent the tongue from obstructing the upper airway and to allow air to pass into the lungs.

B. Oropharyngeal airways can be used only if the patient is unconscious.

1. Two purposes
  - a. Keeps the tongue from blocking the upper airway
  - b. Makes it easier to suction the airway
2. Used in conjunction with BVM device.
3. Should be inserted promptly in unconscious patients who have no gag reflex. Gag reflex: A normal mechanism that causes retching when the soft palate or the back of the throat is touched

4. Must be the proper size and inserted correctly or it could actually push the tongue back into the pharynx and block the airway
5. Measure from the earlobe to the corner of the mouth on the side of the patient's face to determine proper size.
6. Inserting an oropharyngeal airway.
  - a. Select the proper sized airway.
  - b. Open the patient's mouth with one hand.
  - c. Hold the airway upside down and gently insert it with the tip facing the roof of the patient's mouth.
  - d. Rotate the airway 180° until the flange comes to rest on the patient's lips and/or teeth.
  - e. A patient may become responsive and regain the gag reflex after you have inserted the airway.
  - f. Gently remove the airway by pulling it out, following the normal curvature of the mouth and throat.
  - g. Anticipate vomiting.

### C. Nasopharyngeal airways can be used with conscious patients.

1. Nasal or trumpet airways are usually used with conscious patients who are unable to maintain an airway.
2. Consult medical control before inserting it if the patient has severe trauma to the head or face, because nasopharyngeal airways should not be used on patients with possible skull fractures.
3. If the airway is accidentally pushed through the base of the skull, it may penetrate into the brain.
4. Nasal airways are usually well tolerated by patients who have an intact gag reflex.
5. They are not as likely to cause vomiting as oropharyngeal airways.
6. Slight bleeding may occur even when the airway is inserted properly.
7. Never force the airway.
8. One disadvantage is that it usually does not allow for adequate suctioning.
9. Select proper size by measuring from the tip of the nose to the earlobe.
10. Place the airway in the larger nostril, and ensure that the curvature of the device follows the curve of the floor of the nose.
11. Inserting a nasopharyngeal airway
  - a. Select the proper sized airway and coat the tip with a water-soluble lubricant.
  - b. Gently stretch the larger nostril open.
  - c. With the bevel toward the nasal septum, gently insert the airway through the larger nostril until the flange rests against the skin.
  - d. If you encounter any resistance, remove the airway and insert it into the other nostril.

## VII. Suctioning

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Time: 30 Minutes

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Slides: 27-30

Lecture/Discussion

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DOT Ref 2-1-III-C

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DOT Ref 2-1-III-D

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### A. Keep the airway clear in order to ventilate properly.

1. If the patient is gurgling, he or she needs suctioning.
2. Always follow BSI precautions.

### B. Suctioning equipment

1. Portable and fixed (mounted) suctioning equipment are essential for resuscitation.
2. Components of the suctioning unit include:

- a. Tubing
  - b. Plastic, semi-rigid pharyngeal suction tips, called tonsil tips or Yankauer tips
  - c. Nonrigid plastic catheters, called French or whistle-tip catheters
  - d. Collection bottle
  - e. Water for rinsing tips
3. Catheter: A hollow, cylindrical structure that drains or delivers fluids
  4. Tonsil tips are best for suctioning the pharynx. They have a large diameter, are somewhat rigid, and do not collapse.
  5. Be careful not to touch the back of the airway, because this can activate the gag reflex, cause vomiting, and increase the possibility of aspiration.
  6. Soft plastic, nonrigid catheters are used to suction the nose and liquid secretions in the back of the mouth; they are also used when a rigid catheter cannot be used.
  7. Before inserting any catheter, measure for the proper size.
  8. Use the same measuring technique for suctioning as for measuring an airway. Never insert the suction tips past the base of the tongue.
  9. Clean and decontaminate suctioning equipment after each use and inspect it regularly.

### C. Techniques in suctioning

1. Operating the suction unit
  - a. Check the unit for all parts.
  - b. Turn on the unit.
  - c. Select and attach catheter to the tubing.
  - d. Measure the catheter.
  - e. Open the patient's mouth.
  - f. Insert the suction tip only as far as the base of the tongue.
  - g. Suction as you withdraw the tip, moving it from side to side.
  - h. Never suction for more than 15 seconds at one time.
  - i. Rinse the catheter and tubing with water.
  - j. Repeat suctioning only after the patient has been ventilated and re-oxygenated.
2. If a patient has secretions or vomitus that cannot be suctioned quickly and easily, take the following steps:
  - a. Remove the catheter.
  - b. Log roll the patient to the side and carefully clear the mouth with a gloved finger.

### D. Maintaining the airway

1. The recovery position is used to maintain an open airway in a patient with no trauma who is breathing on his or her own.
  - a. Roll the patient onto the left side as a unit and extend the patient's left arm.
  - b. Place the patient's right hand under his or her cheek.
2. Patients who are unconscious and need airway management must be repositioned to provide access to the airway.

## VIII. Supplemental Oxygen

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Time: 30 Minutes

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Slides: 31-36

Lecture/Discussion

DOT Ref 2-1-VI-A

DOT Ref 2-1-VI-B

DOT Ref 2-1-VI-C

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Table 7-2: Oxygen Cylinder Sizes Carried on the Ambulance

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## A. Patients who need supplemental oxygen

1. Patients who are not breathing on their own
2. Any patient with a respiratory or cardiac need
3. Patients who are not breathing well enough to supply adequate oxygen to the lungs
4. Patients in cardiac arrest

## B. Never withhold oxygen from any patient who may benefit from it.

## C. Supplemental oxygen equipment

1. Oxygen cylinders
  - a. Oxygen is usually supplied as a compressed combustible gas in green, seamless steel, or aluminum cylinders.
  - b. Check to make sure that the cylinder is labeled medical oxygen.
    1. Letters and numbers stamped on the collar of the cylinder
    2. Month and year show when the cylinder was last tested.
  - c. Sizes of cylinders
    1. D (or super D) and M cylinders are the most common.
      - a. The D (or super D) cylinder can be carried.
      - b. The large M tank is used as a main supply tank in an ambulance.
    2. Other sizes include A, E, G, H, and K.
2. Pin-indexing system
  - a. The compressed gas industry established a pin-indexing system for portable cylinders to prevent regulator mistakes.
  - b. Always check to be sure that the pinholes on the cylinder exactly match the corresponding pins on the regulator.
3. Pressure regulators
  - a. Gas pressure in a full oxygen cylinder is 2,100 psi—too high to be safe or useful.
  - b. Pressure regulators reduce the pressure to between 40 and 70 psi.
  - c. Final attachments for delivering the gas include:
    1. A quick-connect for a pressure hose, ventilator, or resuscitator
    2. A flowmeter that measures flow in liters/minute (L/min)
4. Humidification
  - a. Some EMS systems provide humidified oxygen to patients during transport.
  - b. This is usually indicated only for long-term oxygen therapies.
  - c. Dry oxygen is not considered harmful for short-term use.
  - d. Always refer to medical control or local protocols.
5. Flowmeters are usually permanently attached to pressure regulators on portable equipment.
  - a. A pressure-compensated flowmeter uses a float ball in a calibrated tube.
    1. Affected by gravity
    2. Must always be upright
  - b. Bourdon-gauge flowmeter is more common in emergency medical use.
    1. Not affected by gravity
    2. Can be used in any position
    3. Disadvantage: does not compensate for backpressure

## D. Operating procedures

1. Inspect the cylinder and its markings.
2. Remove the seal and inspect the opening.
3. “Crack” the cylinder, facing it away from you and others, by turning the handle counterclockwise to open and clockwise to close.
4. Attach the regulator/flowmeter to the valve stem after clearing the opening.
  - a. Check to ensure the O-ring is in place.

- b. Be sure all pins and ports match exactly.
- 5. Open the cylinder and read the pressure level on the regulator gauge.
  - a. Maximum 5 2,100 psi
  - b. Minimum 5 less than 500 psi
- 6. Attach the oxygen device to the flowmeter by connecting the universal oxygen connective tubing to the “Christmas tree” nipple on the flowmeter.
- 7. Open the flowmeter to the desired flow rate. Remember, an EMT-B must be completely familiar with the equipment before attempting to use it on a patient.
- 8. Once the oxygen is flowing, apply the oxygen device to the patient and make any necessary adjustments.
  - a. Monitor the patient’s reaction.
  - b. Periodically recheck the regulator gauge to make sure there is sufficient oxygen.
- 9. When oxygen therapy is complete, disconnect the tubing from the flowmeter nipple and turn off the cylinder valve.
- 10. Discard the delivery device.
- 11. Turn off the flowmeter.
  - a. The gauge on the regulator should read zero with the tank valve closed.
  - b. As long as there is a pressure reading on the regulator gauge, it is not safe to remove the regulator from the valve stem.

## E. Hazards of supplemental oxygen

- 1. Oxygen does not burn or explode, but it does support combustion.
- 2. A small spark can become a flame in an oxygen-rich atmosphere.
- 3. Keep any possible source of fire away from the area.
- 4. Make sure the area is adequately ventilated.
- 5. Safety considerations
  - a. Handle very carefully—contents are under high pressure.
  - b. Be sure the tank is fitted with a pressure regulator so that patients receive the right amount and type of gas.
  - c. Do not handle by the neck assembly alone.
  - d. Secure the cylinder with mounting brackets when storing it on the ambulance.
  - e. Position and secure the cylinder to prevent it from falling and to prevent any damage to the valve-gauge assembly.

# IX. Oxygen Delivery Equipment

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Time: 40 Minutes

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Slides: 37-38

Lecture/Discussion

DOT Ref 2-1-VI-D

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DOT Ref 2-1-VI-D-2

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## A. Nonbreathing mask

- 1. Preferred way of giving oxygen in the prehospital setting
- 2. Capable of providing up to 90% inspired oxygen
- 3. Mask and reservoir bag system
  - a. Oxygen fills a reservoir bag that is attached to the mask by a one-way valve.
  - b. It is called a nonbreathing mask because the exhaled gas escapes through flapper valve ports at the cheek areas of the mask.
- 4. Adjust the flow rate so the bag does not fully collapse with inhalation—usually about 10 to 15 L/min.

## B. Nasal cannula

1. A nasal cannula delivers oxygen through two small, tubelike prongs that fit into the patient's nostrils.
2. They can provide 24% to 44% inspired oxygen if the flowmeter is set at 1 to 6 L/min.
3. They have limited use in the prehospital care setting.
4. Always try to give high-flow oxygen through a nonrebreathing mask if the patient is suspected of having hypoxia, coaching the patient as necessary.
5. If the patient will not tolerate a mask, use a nasal cannula.

## C. Pulse Oximetry

1. Measures the oxygen saturation of hemoglobin in the capillary beds.
2. Probe is placed on the finger or the earlobe.
3. The light source in the probe needs to be unobstructed so fingernail polish should be removed.
4. In most patients the reading will be 98% to 100%.
5. Pulse oximetry is a tool but does not replace a good patient assessment.
6. Patients with difficulty breathing should receive oxygen regardless of their pulse oximetry value.
7. Several conditions can give false values:
  - a. Hypoperfusion
  - b. Hypothermia
  - c. Bleeding
  - d. Anemia
  - e. Carbon monoxide exposure

# X. Artificial Ventilation

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Time: 30 Minutes

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Slides: 39-50

Lecture/Discussion

DOT Ref 2-1-IV

DOT Ref 2-1-IV-C/D

DOT Ref 2-1-IV-E

DOT Ref 2-1-IV-F

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Note: This material may be a review for those students who have completed their basic CPR training. Monitor and modify lecture as needed.

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- A. Fewer than 8 breaths/min or more than 24 breaths/min is considered inadequate.
- B. Fast, shallow breathing can be as dangerous as very slow breathing.
  1. Fast, shallow breathing moves air primarily in the larger airway passages.
  2. It does not allow exchange of air and carbon dioxide in the alveoli.
- C. Patients who are short of breath or cyanotic with cool, clammy skin need oxygen.
- D. An EMT-B may provide artificial ventilation with a one- or two-person BVM device, mouth-to-mask ventilation, or an oxygen-powered ventilation device.
- E. Mouth-to-mouth and mouth-to-mask ventilation are frequently used in emergency situations.
  1. A barrier device is a protective item that features a plastic barrier placed on a patient's face with a one-way valve to prevent the backflow of secretions, vomitus, and gases.

2. Barrier devices provide adequate BSI precautions.
3. Mouth-to-mouth ventilations without a barrier device should be provided only in extreme conditions.
4. A mask with an oxygen inlet provides oxygen during mouth-to-mask ventilation to supplement the air from the rescuer's lungs.
5. Exhaled gas contains 16% oxygen, adequate to support life.
6. The mask may be shaped like a triangle or a doughnut, with the apex (top) placed across the bridge of the nose.
7. The bottom of the mask is placed in the groove between the lower lip and the chin.
8. Rate of artificial ventilations:
  - a. Adult—1 breath every 5 seconds
  - b. Children—1 breath every 3 seconds
  - c. Infants—1 breath every 3 seconds
9. Steps in mouth-to-mask ventilation
  - a. Kneel at the patient's head and open the airway.
  - b. Connect the one-way valve to the face mask.
  - c. Place the mask on the patient's face.
  - d. Grasp the patient's lower jaw with your first three fingers, place your thumbs on the dome, and make an airtight seal by applying firm pressure between the thumbs and fingers.
  - e. Maintain an upward and forward pull on the lower jaw.
  - f. Take a deep breath and exhale through the open port of the one-way valve for 1 1/2 to 2 seconds.
  - g. Remove your mouth, and watch the patient's chest fall.
10. The patient is receiving adequate ventilations if his or her chest rises and falls.
11. Feel for resistance of the patient's lungs as they expand.
12. Listen and feel for air escaping as the patient exhales.
13. High-flow oxygen at 15 L/min through the oxygen inlet valve will increase the oxygen concentration to 55% oxygen.

## F. Bag-valve-mask (BVM) device

1. A BVM device with an oxygen reservoir can deliver more than 90% oxygen at 10 to 15 L/min.
2. A BVM device provides less tidal volume than mouth-to-mask ventilation.
3. A BVM device should be used if there is a need to deliver high oxygen concentrations to patients who are not ventilating adequately.
4. It can also be used for patients in respiratory arrest or severe respiratory failure.
5. An airway adjunct is typically used with the BVM device.
6. This is a skill that must be practiced to be effective.
7. Components of a BVM device:
  - a. Self-refilling bag, disposable or easily cleaned
  - b. No pop-off valve
  - c. A true valve for nonrebreathing
  - d. Transparent self-inflating deflatable oxygen reservoir bag
  - e. A one-way, no-jam valve that provides an oxygen inlet flow at a maximum of 30L/min with standard 15/22 mm fittings for face mask and endotracheal connection
  - f. Transparent face masks in appropriate sizes
  - g. Ability to perform in extreme heat or cold
  - h. Volume capabilities of the BVM device
    1. 1,200 to 1,600 mL for an adult
    2. 500 to 700 mL for children
    3. 150 to 240 mL for infants.
8. Technique

- a. Work with a partner whenever possible.
- b. It may be difficult for one EMT-B to both maintain a proper seal between the mask and face with one hand and get adequate air into the patient.
- c. Steps in two-person BVM ventilation
  1. The first EMT-B kneels above the patient's head; the second EMT-B will bag the patient while the first EMT-B holds the seal.
  2. The patient's neck should be maintained in an extended position unless cervical spine injury is suspected.
  3. The second EMT-B opens the patient's mouth and suctions as needed, then inserts an airway adjunct.
  4. The second EMT-B selects the proper mask size.
  5. The second EMT-B places the mask on the patient's face. The top should be over the bridge of the nose and the bottom should be in the groove between the lower lip and the chin.
  6. The second EMT-B brings the patient's lower jaw up to the mask, using the fourth and fifth fingers.
  7. The first EMT-B holds the mask in position by placing the thumbs over the top part of the mask and the index and middle fingers over the bottom half. Do not grab the fleshy part of the neck.
  8. The second EMT-B connects the bag to the mask.
  9. The first EMT-B holds the mask in place while the second EMT-B squeezes the bag with two hands until the patient's chest rises, once every 5 seconds for adults and once every 3 seconds for infants and children.
- d. Steps in one-person BVM ventilation
  1. Hold your index finger over the lower part of the mask and secure the upper part of the mask with your thumb (C-clamp) to maintain the seal.
  2. Use the head tilt-chin lift maneuver to extend the patient's neck.
  3. Make sure that your fourth and fifth fingers are not putting pressure on the neck.
  4. Squeeze the bag, using one hand, until the patient's chest rises, once every 5 seconds for adults and once every 3 seconds for infants and children.
- e. When using the device to assist respirations, deflate the bag as the patient tries to breathe in.
- f. If the patient's chest does not rise and fall, try to reposition the head or use an airway adjunct.
- g. If the stomach seems to be rising and falling, reposition the head.
- h. In a patient with a possible spinal injury, reposition the jaw rather than the head.
  - i. If too much air is escaping from under the mask, reposition the mask for a better mask seal.
  - j. Try another airway device if all troubleshooting fails.
- k. The BVM device may also be used in conjunction with an endotracheal tube or with other airway adjuncts, such as the Esophageal Tracheal Combitube, the Pharyngeotracheal Lumen Airway, and the Trach-light.

## G. Flow-restricted, oxygen-powered ventilation devices

1. Not recommended for use on patients with COPD or chest injury, or on infants and children
2. Use cricoid pressure
3. Components
  - a. Delivers a peak flow rate of 100% oxygen up to 40 L/min
  - b. Inspiratory pressure safety release valve
  - c. Audible alarm
  - d. Operates satisfactorily under both normal and varying environmental conditions
  - e. A trigger (or lever), positioned so that both hands can remain on the mask to provide an airtight seal while supporting and tilting the patient's head and keeping the jaw elevated.

4. The EMT-B must make sure that there is an airtight fit between the patient's face and the mask.
5. The EMT-B must also be alert for gastric distention.
6. The amount of pressure necessary to ventilate adequately will vary depending on the size of the patient, the patient's lung volume, and the condition of the lungs.
7. Always follow local medical protocols.

#### 8. Technique

- a. Open the airway, suction as needed, and insert an airway adjunct.
- b. Place the thumbs over the top half of the mask and the index and middle fingers over the bottom half.
- c. Place the top of the mask over the bridge of the nose and the bottom over the mouth and upper chin.
- d. Using the fourth and fifth fingers, bring the lower jaw up to the mask.
- e. Trigger the device's demand valve until the patient's chest rises.
- f. Ventilate at the appropriate rate.
- g. Troubleshoot improper techniques using these cues:
  1. If the abdomen rises, reposition the head.
  2. If air is leaking from under the mask, reposition the fingers.
  3. If the above two methods fail, consider using techniques for complete airway obstruction or another method of ventilating.

h. Flow-restricted, oxygen-powered ventilation devices may be used with an endotracheal tube or with other airway adjuncts.

### H. Ongoing assessment of ventilation

1. Adequate ventilation
  - a. Equal chest rise and fall
  - b. Ventilating at appropriate rate
  - c. Heart rate returns to normal
2. Inadequate ventilation
  - a. Minimal or no chest rise and fall; if chest is not rising and falling, reposition the head or try cricoid pressure
  - b. Ventilations too fast or too slow; if ventilations still do not go in, manage for an airway obstruction.
  - c. Heart rate does not return to normal.

### I. Cricoid pressure

1. This is also referred to as the Sellick maneuver.
2. Used on unconscious patients to avoid gastric distension
3. Locate cricoid at inferior border of larynx.
4. Press down with thumb and index finger on each side of cricoid.
5. Pressure occludes the esophagus, decreasing gastric distension and lowering the chance of aspiration.

## XI. Special Considerations

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Time: 10 Minutes

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Slides: 51-52

Lecture/Discussion

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DOT Ref 2-1-VII-A

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### A. Gastric distention

1. Artificial ventilation fills the stomach with air.
2. Distention occurs when the EMT-B blows too forcefully or too often in artificial ventilation or when the airway is obstructed.
3. Severe inflation of the stomach is dangerous because it causes vomiting during CPR.
4. Distention can also reduce the lung volume by elevating the diaphragm.
5. If the stomach becomes distended, recheck and reposition the airway and watch for rise and fall of the chest.
6. Continue slow rescue breathing.
7. Applying manual pressure over the patient's upper abdomen will likely result in vomiting.
8. If vomiting occurs, turn the patient to the side, suction and/or wipe out the mouth with a gloved hand, and return the patient to a supine position so that CPR can be continued.

### B. Stomas and tracheostomy tubes

1. BVM ventilation must also be used for patients who have had a laryngectomy.
2. These patients have a permanent tracheal stoma.
3. Ignore any opening other than the midline tracheal stoma; it is the only one that puts air in the lungs.
4. Neither the head tilt-chin lift nor the jaw-thrust maneuver is required for ventilating a patient with a stoma.
5. If the patient has a tube in the stoma, ventilate through the tube.
6. Attach BVM device to the tube.
7. Use an infant or child mask with the BVM device to make a seal, if no tube is present.
8. Seal the patient's mouth and nose with one hand to prevent air from leaking.
9. Release the seal of patient's mouth and nose to allow the patient to exhale.
10. If ventilation is unsuccessful, try suctioning the stoma and the mouth with a soft or satin tip catheter before giving artificial ventilation through the mouth and nose.

## XII. Foreign Body Obstruction

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Time: 10 Minutes

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Slides: 53-55

Lecture/Discussion

DOT Ref 2-1-VII-D

DOT Ref 2-1-VII-E

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Note: You may refer students to Chapter 39 for a review of BLS airway procedures involving foreign body obstruction.

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### A. True emergency that will result in death if not corrected

### B. Causes

1. The presence of one or more of the following conditions can cause foreign body airway obstruction:

- a. Relaxation of the tongue
- b. Vomited stomach contents
- c. Blood clots, bone fragments, or damaged tissue
- d. Swelling caused by medical conditions
  1. Infection or acute allergic reactions
  2. Attempting to clear an airway obstruction caused by a medical condition will be unsuccessful. These patients need specific care.

e. Foreign objects

1. In an adult, sudden airway obstruction by a foreign object usually occurs during a meal.
  2. In a child, it occurs while eating, playing with small toys, or crawling around the house.
  3. An otherwise healthy child who suddenly has difficulty breathing has probably aspirated a foreign object.
2. The sooner airway obstruction is recognized, the better.
3. If a patient has a partial airway obstruction, air exchange will continue and the patient will have noisy breathing.
- a. With good air exchange, the patient is able to breathe and cough but should be closely monitored.
  - b. If the patient has poor air exchange, he or she should be treated as if the airway is completely blocked.

### C. Signs of foreign body obstruction

1. Sudden inability to speak or cough during or immediately after eating.
2. Little or no air movement.

### D. Actions

1. Ask first, "Are you choking?"
2. If the patient nods "yes," then act.
3. If the patient is unconscious, the cause may not be obvious at first.
  - a. Open the airway and provide artificial ventilation.
  - b. If there is resistance while ventilating the patient's lungs, airway obstruction may be the reason.

### E. Removal techniques

1. Use the Heimlich maneuver (abdominal thrusts) followed by finger sweeps and manual removal for a complete airway obstruction.
2. Perform the head tilt-chin lift maneuver to clear an obstruction that is caused by the tongue.
3. Loose dentures and large pieces of vomited food, mucus, or blood clots in the mouth should be swept forward and out of the mouth with a gloved index finger.
4. Suctioning should be used to maintain a clear airway.
5. If there is a partial airway obstruction, the patient will be breathing noisily and may be coughing.
6. As long as the patient can breathe, cough, or talk, do not interfere with any attempts to expel the foreign object.

#### D. Dental appliances

1. Always check the airway for any foreign object or substance.
2. If a dental appliance is loose, remove it.

#### E. Facial bleeding: control with direct pressure.

#### F. If attempts to clear the airway are unsuccessful, transport rapidly.

## XIII. Skill Drills

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Time: 120 Minutes

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Demonstration/Group Activity

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Remember to maintain an adequate instructor to student ratio. A ratio of 1 instructor to 6 students is recommended by the DOT National Standard Curriculum. Also remember that each student is to be evaluated on each skill prior to the completion of the course.

### Purpose

Following instructor-facilitated demonstrations, this activity allows students to observe patient care skills associated with airway management and practice and demonstrate competency in airway management skills.

### Materials Needed

1. BSI supplies
2. Airway training manikin (adult, child, and infant)
3. Assorted airways (oral/nasal, adult/pediatric) and lubricant
4. Pocket mask
5. Suctioning unit and assorted catheters
6. Oxygen cylinders, regulators, flowmeters, and tubing

### Instructor Directions

1. Demonstrate each skill, placing emphasis on describing to the students any critical points or procedures.
2. On the basis of the specific skill, assign each student to a partner or team. Provide each partner/team with equipment or materials as needed.
3. Direct students to practice each skill using team members as patients and observers. Closely monitor the practice sessions

and provide constructive comments and redirecting.

4. As individual students achieve success, conduct skill proficiency exams. Students failing the exam should be given redirection and an opportunity to practice before being retested.

## Skills

- A. Positioning an Unconscious Patient (Skill Drill 7-1)
- B. Head Tilt-Chin Lift Maneuver (Figure 7-12)
- C. Performing the Jaw-Thrust Maneuver (Skill Drill 7-2)
- D. Inserting an Oral Airway (Skill Drill 7-3)
- E. Inserting a Nasal Airway (Skill Drill 7-5)
- F. Suctioning a Patient's Airway (Skill Drill 7-6)
- G. Placing an Oxygen Cylinder into Service (Skill Drill 7-7)
- H. Performing Mouth-to-Mask Ventilation (Skill Drill 7-8)

## Post-Lecture

### I. Prep Kit Activities

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Time: 60 Minutes

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Small Group/Individual Activity/Discussion

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Note: The Prep Kit contains various student-centered end-of-chapter activities designed as enhancement to the instructor's presentation. As time permits, these activities may be presented in class. They are also designed to be used as take-home activities.

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#### A. Assessment in Action

This activity is designed to assist the student in gaining a further understanding of issues surrounding airway management. The activity incorporates both critical thinking and application of EMT-B knowledge.

#### Purpose

This activity allows the student an opportunity to analyze an emergency care scenario and develop responses to critical thinking questions.

#### Instructor Directions

1. Direct students to read the "Assessment in Action" scenario located in the Prep Kit at the end of Chapter 7.
2. Direct students to read and individually answer the quiz questions at the end of the scenario. Allow approximately 10 minutes for this part of the activity. Facilitate a class review and dialogue of the answers, allowing students to correct responses as needed. Use the quiz question answers noted below to assist in building this review. Allow approximately 10 minutes for this part of the activity.
3. You may also assign these as individual activities and ask students to turn in their comments on a separate piece of paper.

#### Answers to Multiple-Choice Questions

1. Answer: B The jaw-thrust maneuver would be correct in this situation. Because a cervical spine injury is suspected, do not tilt or move the head.
2. Answer: B A whistle-diameter tip would be the best because you do not know when the patient last ate. Suspect the worst first. Occasionally even the tonsil tip is too small for food debris so the suction tubing used to attach to the tonsil tip is sometimes used.
3. Answer: A If everything goes right, 15 seconds should be sufficient.  
Any more time will aggravate hypoxia. However, if a patient's airway continues to be filled with vomitus, the priority is to clear the airway as quickly as possible.
4. Answer: C The distance from the earlobe to the nose is the proper way to measure for the nasopharyngeal airway; the angle of the jaw to the nose and the angle of the jaw to the corner of the mouth will be too short.
5. Answer: C The primary purpose of a correctly placed oral airway is to keep the tongue forward. It has no effect on jaw position or regurgitation, but it can cause retching or vomiting. It only determines if a patient has an intact gag reflex, not a return to consciousness.
6. Answer: D Immediately remove the airway to reduce the risk of vomiting and aspiration. To insert a nasopharyngeal airway might be the next step, but the first action is to eliminate the stimulus to vomit. The stimulus to vomit is not stopped once

ventilation is started. To try again will cause the same reaction.

7. Answer: A or C Signs of successful ventilations include good chest rise and fall, a normal pulse rate, and normal skin color. A distended abdomen suggests gastric distention. Cool skin may not be related to ventilations.

8. Answer: C In this case a spinal injury was suspected so the jaw-thrust maneuver would have been appropriate. To hyperextend the head or do a head tilt-chin lift would have compromised the cervical spine. The recovery position is not appropriate when spinal trauma is suspected.

### Challenging Questions Answers

9. Answer: The pulse became stronger because the heart muscle was getting more oxygen. When the heart muscle does not receive sufficient oxygen, it cannot pump as efficiently. This may cause an irregular pulse or weak contractions of the heart, a fall in blood pressure, or both. Without sufficient oxygen, ischemia develops in the cells of the heart and, if not oxygenated, these cells may die.

10. Answer: Washing out surfactant from the alveoli will interrupt efficient exchange of oxygen and carbon dioxide and severe respiratory distress will occur.

11. Answer: Because the nerves to the muscles of respiration (diaphragm and muscles of the chest wall) go through the spinal cord and can be threatened by cervical spine injury.

### Answers to Second Set of Questions

1. Answer: D Because the patient is talking to you, his airway is open. He is breathing and has a pulse so CPR and insertion of an oropharyngeal airway are unnecessary.

2. Answer: A or B His pulse rate and blood pressure by themselves do not indicate a respiratory problem, and his complaint of chest tightening does not indicate inadequate respirations, although it may be an indirect result of hypoxia to his heart and is important to monitor.

3. Answer: A His chief complaint, difficulty breathing, is related to his history of asthma, which is significant enough to use a Ventolin inhaler. His allergy to penicillin is not related to the problem. The patient's hypertension is another problem not related to his current difficulty breathing.

### Challenging Question Answer

4. Answer: Removing the patient from the area because he suspects that dust triggered his attack. He needs to breathe fresh air.

### B. Points to Ponder

This activity will allow you to help your students probe the more difficult situations that they face. Use this as an opportunity to allow them to express differences of opinion and approach, while directing them to be thorough and decisive in their answers. Encourage challenges.

### Purpose

To allow students an opportunity to apply critical thinking analysis to a given case study or situation.

### Instructor Directions

1. Direct students to read the "Points to Ponder" scenario found in the Prep Kit at the end of Chapter 7.

2. You may assign students to a partner or a group and direct them to review the discussion question at the end of the scenario and prepare a response. Allow approximately 10 minutes for this part of the activity. Facilitate a class dialogue centered on the discussion point. Allow approximately 10 minutes for this part of the activity.

3. You may also assign this as an individual activity and ask students to turn in their comments on a separate piece of paper.

4. Personally review the scenario and discussion question based on your experience and knowledge as an emergency care worker. Develop your own key points for guiding this discussion.

### Scenario

You are dispatched to a "traffic stop" where you find that the local law enforcement agency has a person subdued. The person is on his side and you immediately notice that he is cyanotic. You ask the law enforcement

officers to release him so that you may examine him better and they refuse. They explain that he was quite violent, requiring three people to control him, but that he has been less aggressive since they subdued him. Your partner says that the patient has decreased level of consciousness and labored breathing. The officers still decline to release the patient. What would you do? Would you report this and if so to whom? How might reporting this affect your relationship with law enforcement in the future?

### Issues

- Scene Safety
- Best Patient Care
- Relationship with other Emergency Services
- Reporting Channels

### C. Online Outlook

This activity requires students to have access to the Internet. This may be accomplished through personal access, employer access, or through a local educational institution. Some community colleges, universities, or adult education centers may have classrooms with Internet capability that will allow for this activity to be completed in class. Check out local access points and encourage students to complete this activity as part of their ongoing reinforcement of EMT-B knowledge and skills.

### Purpose

To provide students an opportunity to reinforce chapter material through use of online Internet activities.

### Instructor Directions

1. Use the Internet and go to [www.emtb.com](http://www.emtb.com). Follow the directions on the web site to access the exercises for Chapter 7.
2. Review the chapter activities and take note of desired or correct student responses.
3. As time allows, conduct an in-class review of the Internet activity and provide feedback to students as needed.
4. Be sure to check the web site before assigning this activity, as specific chapter-related activities may change from time to time.

## II. Lesson Review

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Time: 10 Minutes

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Discussion

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Note: Facilitate the review of this lesson's major topics using the review questions as direct questions or overhead transparencies. Answers are found throughout this lesson plan with IRK references listed for each question.

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- A. Describe the signs of hypoxia. (Lecture II-D)
- B. Describe inadequate breathing and how to assess it. (Lecture III-B)
- C. Describe the procedures for opening the airway and when to use each. (Lecture V-F, G)
- D. Describe the use of and procedures for inserting oral and nasal airways. (Lecture VI-B, C)
- E. List the steps in suctioning. (Lecture VII-C)
- F. List the maximum and minimum useable units of pressure in an oxygen cylinder. (Lecture VIII)
- G. Describe a nasal cannula and list its limitations. (Lecture IX-B)
- H. What are the components of a BVM device? (Lecture X-F)
- I. Describe the limitations for use of flow-restricted oxygen-powered ventilation devices. (Lecture X-G)
- J. Explain how to ventilate a patient with a stoma. (Lecture XI-B)

## III. Assignments

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Time: 5 Minutes

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Lecture

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- A. Review all materials from this lesson and be prepared for a lesson quiz to be administered (date to be determined by instructor).
- B. Read Chapter 8: *Patient Assessment* for the next class session.