

Module 2: Airway

Lesson 2-1 Airway

Objectives

Objectives Legend

C=Cognitive P=Psychomotor A=Affective

1 = knowledge level

2 = Application level

3 = Problem-solving level

Cognitive Objectives

At the completion of this lesson, the CFR student will be able to:

- 2-1.1 List the components of the respiratory system (C-1)
- 2-1.2 Describe the physiology of breathing for adults, children and infants (C-1)
- 2-1.3 List the signs of adequate breathing (C-1)
- 2-1.4 List the signs of inadequate breathing. (C-1)
- 2-1.5 List the methods for opening an airway, with and without suspected spinal trauma (C-1)
- 2-1.6 Describe the steps in the head-tilt chin-lift. (C-1)
- 2-1.7 Relate mechanism of injury to opening the airway. (C-3)
- 2-1.8 Describe the steps in the jaw thrust. (C-1)
- 2-1.9 Describe the indications and techniques used to inspect the airway for compromise.
- 2-1.10 State the importance of having a suction unit ready for immediate use when providing emergency medical care. (C-1).
- 2-1.11 Describe the techniques of suctioning. (C-1)
- 2-1.12 Describe how to ventilate a patient with a pocket mask or barrier device. (C-1)
- 2-1.13 Describe the steps in performing the skill of artificially ventilating a patient with a bag-valve-mask while using the jaw thrust (C-1)
- 2-1.14 List the parts of a bag-valve-mask system. (C-1)
- 2-1.15 Describe the steps in performing the skill of artificially ventilating a patient with a bag-valve-mask for one and two rescuers. (C-1)
- 2-1.16 Describe the signs of adequate artificial ventilation using the bag-valve-mask. (C-1)
- 2-1.17 Describe the signs of inadequate artificial ventilation using the bag-valve-mask. (C-1)
- 2-1.18 Describe the steps in artificially ventilating a patient with a flow restricted oxygen-powered ventilation device. (C-1)
- 2-1.19 Describe how ventilating an infant or child is different from an adult.
- 2-1.20 List the steps in providing mouth-to-barrier device and mouth-to-stoma ventilation. (C-1)
- 2-1.21 Describe how to measure and insert an oropharyngeal (oral) airway. (C-1)
- 2-1.22 Describe how to measure and insert a nasopharyngeal (nasal) airway.
- 2-1.23 Define the components of an oxygen delivery system. (C-1)
- 2-1.24 Identify a non-rebreathing facemask and state the oxygen flow requirements needed for its use. (C-1)

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- 2-1.25 Identify a nasal cannula and state the flow requirements needed for its use. (C-1)
- 2-1.26 Describe the indications for using a nasal cannula versus a nonrebreather facemask. (C-1)
- 2-1.27 Describe how to clear a foreign body airway obstruction in a responsive adult. (C-1)
- 2-1.28 Describe how to clear a foreign body airway obstruction in a responsive child with complete obstruction or partial airway obstruction and poor air exchange. (C-1)
- 2-1.29 Describe how to clear a foreign body airway obstruction in a responsive infant with complete obstruction or partial airway obstruction and poor air exchange. (C-1)
- 2-1.30 Describe how to clear a foreign body airway obstruction in a unresponsive adult. (C-1)
- 2-1.31 Describe how to clear a foreign body airway obstruction in a unresponsive child. (C-1)
- 2-1.32 Describe how to clear a foreign body airway obstruction in a unresponsive infant. (C-1)

Affective Objectives

At the completion of this lesson, the CFR student will be able to:

- 2-1.33 Explain why basic life support ventilation and airway protective skills take priority over most other basic life support skills. (A-3)
- 2-1.34 Demonstrate a caring attitude towards patients with airway problems who request emergency medical services. (A-3)
- 2-1.35 Place the interests of the patient with airway problems as the foremost consideration when making any and all patient care decisions. (A-3)
- 2-1.36 Communicate with empathy to patients with airway problems, as well as with family members and friends of the patient. (A-3)

Psychomotor Objectives

At the completion of this lesson, the CFR student will be able to:

- 2-1.37 Demonstrate the steps in the head-tilt chin-lift. (P-1, 2)
- 2-1.38 Demonstrate the steps in the jaw thrust. (P-1, 2)
- 2-1.39 Demonstrate the techniques of suctioning. (P-1, 2)
- 2-1.40 Demonstrate the steps in mouth-to mouth ventilation with body substance isolation (barrier shields). (P-1, 2)
- 2-1.41 Demonstrate how to use a pocket mask to ventilate a patient.
- 2-1.42 Demonstrate the assembly of a bag-valve-mask unit. (P-1, 2)
- 2-1.43 Demonstrate the steps in performing the skill of artificially ventilating a patient with a bag-valve-mask for one and two rescuers. (P-1, 2)
- 2-1.44 Demonstrate the steps in performing the skill of artificially ventilating a patient with a bag-valve-mask while using the jaw thrust. (P-1, 2)
- 2-1.45 Demonstrate artificial ventilation of a patient with a flow restricted, oxygen powered ventilation device. (P-1, 2)
- 2-1.46 Demonstrate how to ventilate a patient with a stoma. (P-1, 2)

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- 2-1.47 Demonstrate how to measure and insert an oropharyngeal (oral) airway
- 2-1.48 Demonstrate how to measure and insert a nasopharyngeal (nasal) airway. (P-1, 2)
- 2-1.49 Demonstrate how to ventilate infant and child patients. (P-1, 2)
- 2-1.50 Demonstrate how to clear a foreign body airway obstruction in a responsive adult. (C-1)
- 2-1.51 Demonstrate how to clear a foreign body airway obstruction in a responsive child. (C-1)
- 2-1.52 Demonstrate how to clear a foreign body airway obstruction in a responsive infant. (C-1)
- 2-1.53 Demonstrate how to clear a foreign body airway obstruction in an unresponsive adult. (C-1)
- 2-1.54 Demonstrate how to clear a foreign body airway obstruction in an unresponsive child. (C-1)
- 2-1.55 Demonstrate how to clear a foreign body airway obstruction in an unresponsive infant. (C-1)

Preparation

Motivation:

A patient without an airway has no chance of survival. It is important for the CFR to be able to manage an airway with and without airway adjuncts.

Materials

AV Equipment:

Utilize various audio-visual materials relating to emergency medical care. The continuous development of new audio-visual materials relating to EMS requires careful review to determine which best meet the needs of the program. Materials should be edited to ensure that the objectives of the curriculum are met.

EMS Equipment:

Pocket mask, barrier devices, bag-valve-mask, oral airways, nasal airways, suction units (manual and battery powered), suction catheters, tongue blade; lubricant, oxygen tank, regulator, nonrebreather mask, nasal cannula, flow restricted oxygen powered ventilation device, airway management training manikins and CPR manikins.

Personnel

Primary Instructor:

One EMT-B instructor knowledgeable in airway management.

Assistant Instructor:

The instructor-to-student ratio should be 1:6 for psychomotor skill practice. Individuals used as assistant instructors should be knowledgeable in airway techniques and management.

Recommended Minimum Time to Complete:

Three Hours

Presentation

Declarative (What)

- I. The Respiratory system
 - A. Function
 0. Deliver oxygen to the body
 1. Remove carbon dioxide from the body
 - B. Components/anatomy
 1. Nose and mouth
 2. Pharynx
 - a. Oropharynx
 - b. Nasopharynx
 3. Epiglottis - a leaf-shaped structure that prevents food and liquid from entering the trachea during swallowing.
 4. Windpipe (trachea)
 5. Voice box (larynx)
 6. Lungs
 7. Diaphragm
 - C. Physiology of breathing
 1. Diaphragm moves down, chest moves out, drawing air into the lungs (inhalation)
 2. Exchange of oxygen and carbon dioxide in the lungs
 3. Diaphragm moves up causing air to exit the lungs (exhalation)
 4. Adequate breathing
 - a. Normal rate
 - (1) Adult - 12-20 / minute
 - (2) Child - 15-30 / minute
 - (3) Infant - 25-50 / minute
 - b. Rhythm
 - (1) Regular
 - (2) Irregular
 - c. Quality
 - (1) Breath sounds - present and equal
 - (a) Free of gurgling, gasping, crowing and wheezing
 - d. Chest expansion - adequate and equal
 - (1) Minimum effort of breathing - use of accessory muscles - predominantly in infants and children
 - e. Depth (tidal volume)
 - (1) Adequate and equal expansion of both sides of the chest.
 5. Inadequate breathing
 - a. Rate - outside of normal ranges
 - b. Rhythm - irregular
 - c. Quality
 - (1) Breath sounds - diminished or absent
 - (2) Chest expansion - unequal or inadequate

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- (3) Increased effort of breathing - use of accessory muscles - predominantly in infants and children
 - d. Depth (tidal volume) - inadequate/shallow
 - e. The skin may be pale or cyanotic (blue) and cool and clammy.
 - f. There may be retractions above the clavicles, between the ribs and below the rib cage, especially in children
 - g. Nasal flaring may be present, especially in children.
 - h. In infants, there may be "seesaw" breathing where the abdomen and chest move in opposite directions
 - i. Agonal respirations (occasional gasping breaths) may be seen just before death.
 - D. Infant and child anatomy and physiology considerations
 - 1. All structures are smaller and more easily obstructed than in adults.
 - 2. Infants' and children's tongues take up proportionally more space in the mouth than adults.
 - 3. The trachea is more flexible in infants and children.
 - 4. The primary cause of cardiac arrest in infants and children is an uncorrected respiratory problem.
- II. Opening the Airway
 - A. One of the most important actions that the CFR can perform is opening the airway of an unresponsive patient.
 - 1. An unresponsive patient loses muscle tone, and the soft tissue and base of the tongue may occlude the airway.
 - 2. The tongue is the most common cause of airway obstruction in an unresponsive patient.
 - 3. Since the tongue is attached to the lower jaw, moving the jaw forward will lift the tongue away from the back of the throat.
 - B. Head-tilt chin-lift
 - 1. The method of choice for opening the airway in uninjured patients
 - 2. Research has indicated that the head-tilt chin-lift consistently provides the optimal airway.
 - 3. Used for uninjured, unresponsive patients
 - 4. Technique
 - a. Place your hand that is closer to the patient's head on his/her forehead, apply firm backward pressure to tilt the head back.
 - b. Place the fingers of your hand that is closer to the patient's feet on the bony part of his/her chin.
 - c. Lift the chin forward and support the jaw, helping to tilt the head back.
 - 5. Precautions
 - a. Finger must not press deeply into the soft tissues of the chin as this may lead to airway obstruction.
 - b. The thumb should not be used for lifting the chin.
 - c. The mouth must not be closed.

- C. Jaw thrust without head tilt
 - 1. This technique is an alternative method of opening the airway.
 - 2. Effective but fatiguing and technically difficult
 - 3. This is the safest approach to opening the airway in the patient with a suspected spinal injury.
 - 4. Indications
 - a. Used for trauma patients
 - b. Used for unresponsive patients
 - 5. Technique
 - a. Grasp the angles of the patient's lower jaw.
 - b. Lift with both hands displacing the mandible forward.
 - c. If the lips close, open the lower lip with your gloved thumb.

- III. Inspect the Airway
 - A. An unresponsive patient may have fluid or solids in the airway that may compromise the airway.
 - B. Responsive patients who cannot protect their airway should also have their airways inspected.
 - C. Indications
 - 1. All unresponsive patients
 - 2. Responsive patients who may not be able to protect their own airways.
 - D. Technique
 - 1. Open the patient's mouth with a gloved hand.
 - 2. Look inside the airway.
 - a. Clear (patent)
 - b. Blocked
 - (1) Fluid
 - (2) Solids
 - (3) Teeth, including dentures

- VI. Determining Presence of Breathing
 - A. Immediately after opening the airway, check for breathing
 - B. As you determine the presence of breathing, look at the effort or work of breathing.
 - 1. Breathing should be effortless.
 - 2. Observe the chest for adequate rise and fall.
 - 3. Look for accessory muscle use.
 - C. Techniques
 - 1. Responsive patients
 - a. Ask: "Can you speak?", "Are you choking?"
 - b. The ability to talk or make vocal sounds indicates that air is moving past the vocal cords
 - 2. Unresponsive patients
 - a. Maintain an open airway
 - b. Place your ear close to the patients mouth and nose
 - c. Assess for three to five seconds.

- (1) Look for the rise and fall of the chest
 - (2) Listen for air escaping during exhalation
 - (3) Feel for air coming from the mouth and nose
 - d. The CFR may observe the rise and fall of the chest even if an airway obstruction is present, but will not hear or feel air movement
 - e. Some reflex gasping (agonal respirations) may be present just after cardiac arrest. This should not be confused for breathing.
- D. Adequate breathing is characterized by the following:
1. Normal Rate
 - a. Adult - 12-20 / minute
 - b. Child - 15-30 / minute
 - c. Infant - 25-50 / minute
 2. Rhythm
 - a. Regular
 - b. Irregular
 3. Quality
 - a. Breath sounds - present and equal
 - (1) Free of gurgling, gasping, crowing or wheezing
 4. Chest expansion - adequate and equal
 - a. Minimum effort of breathing - use of accessory muscles - predominantly in infants and children
 5. Depth (tidal volume)
 - a. Adequate and equal expansion of both sides of chest
- E. Inadequate breathing is characterized by the following:
1. Rate
 - a. Less than 8 in adults
 - b. Less than 10 in children
 - c. Less than 20 in infants
 2. Inadequate chest wall motion
 3. Cyanosis
 4. Mental status changes
 5. Increased effort
 6. Gasping
 7. Grunting
 8. Slow heart rate associated with slow respirations
- V. Airway Adjuncts
- A. Oropharyngeal (oral) airways
1. Oropharyngeal (OP) airways may be used to assist in maintaining an open airway in an unresponsive patient without a gag reflex.
 2. Patients with a gag reflex may vomit when this airway is used.
 3. Technique
 - a. Select the proper size: Measure from the corner of the patient's lips to the tip of the earlobe or angle of jaw.
 - b. Open the patient's mouth.

- c. Insert the airway upside down, with the tip facing toward the roof of the patient's mouth.
 - d. Advance the airway gently until resistance is encountered.
 - e. Turn the airway 180 degrees so that it comes to rest with the flange on the patient's teeth.
 4. Alternate technique - For use with infants and children
 - a. Select the proper size: Measure from the corner of the patient's lips to the bottom of the earlobe or angle of jaw.
 - b. Open the patient's mouth.
 - c. Use a tongue blade to press tongue down and away.
 - d. Insert airway in upright (anatomic) position.
 - B. Nasopharyngeal (nasal) airways
 1. Nasopharyngeal (NP) airways are less likely to stimulate vomiting.
 2. May be used on patients who are responsive but need assistance maintaining an airway.
 3. Even though the tube is lubricated, this is a painful stimulus.
 4. Technique
 - a. Select the proper size: Measure from the tip of the nose to the tip of the patient's ear.
 - b. Also consider diameter of airway in the nostril. NP airways should not be so large that it causes blanching of the nostril.
 - c. Lubricate the airway with a water soluble lubricant.
 - d. Insert it posteriorly. Bevel should be toward the base of the nostril or toward the septum.
 - e. The right nostril is preferred.
 - e. If the airway cannot be inserted into one nostril, try the other nostril.
 - f. Do not force this airway.
- VI. Ventilation
- A. Once the airway has been assured, and breathing is assessed, breathing for the patient may be necessary.
 - B. If the patient is not breathing they only have the oxygen in their lungs and their bloodstream remaining.
 - C. In order to prevent death, the CFR must ventilate the patient.
 - D. There are many techniques for ventilation--the CFR must be competent in the following three techniques of ventilation
- VII. Techniques of Ventilation
- A. The techniques of ventilation in order of preference are
 1. Two-person bag-valve-mask
 2. Flow restricted, oxygen-powered ventilation device
 3. One-person bag-valve-mask
 4. Mouth to mask
 5. Mouth to barrier device
 6. Mouth to mouth

- B. Bag-valve-mask
1. The bag-valve-mask consists of a self-inflating bag, one-way valve, face mask, oxygen reservoir. Oxygen should be used for most effective performance. --
 2. Bag-valve-mask issues:
 - a. Volume of approximately 1,600 milliliters
 - b. Provides less volume than mouth to mask
 - c. Single CFR may have difficulty maintaining an airtight seal.
 - d. Two CFRs using the device will be more effective.
 - e. Position self at top of patient's head for optimal performance.
 - f. Adjunctive airways (oral or nasal) may be necessary in conjunction with bag-valve-mask.
 - g. The bag-valve-mask should:
 - (1) Be a self-refilling bag that is easily cleaned and sterilized.
 - (a) Disposable is preferred
 - (b) Non disposable must be cleaned and sterilized.
 - (2) have a non-jam valve that allows a maximum oxygen inlet flow of 15 LPM.
 - (3) have no pop-off valve, or the pop-off valve must be disabled. Failure to do so may result in inadequate artificial ventilation.
 - (4) Have standardized 15/22 mm fittings.
 - (5) have an oxygen inlet and reservoir to allow for high concentration of oxygen.
 - (6) have a one way valve to prevent patient from rebreathing expired air.
 - (7) have the ability to function in all environmental conditions and temperature extremes.
 - (8) have appropriate infant, child and adult sizes of masks and bags available.
 - h. Selecting and sizing a mask
 - (1) Have an air Cushion
 - (2) Clear face piece
 - (3) Apex (top) of mask is placed on bridge of nose
 - (4) Base of mask is placed in the groove between the lower lip and the chin.
 3. When no spinal trauma is suspected.
 - a. After opening airway, insert the appropriate sized oral or nasal airway adjunct, select correct mask size (adult, child or Infant).
 - b. Connect bag to mask and oxygen if not already done.
 - c. Position thumbs over top half of mask, index and middle fingers over bottom half.

- d. Place apex of mask over bridge of nose, then lower mask over mouth and upper chin. If mask has large round cuff surrounding a ventilation port, center port over mouth.
 - e. Use ring and little fingers to bring jaw up to mask.
 - f. Have assistant squeeze bag with two hands until chest rises.
 - g. If alone, form a "C" around the ventilation port with thumb and index finger; use middle, ring and little fingers under jaw to maintain chin lift and complete the seal. Using the hand, squeeze the bag until the chest rises.
 - h. Ventilate a minimum of every 5 seconds for adults and every 3 seconds for children and infants.
 - i. If chest does not rise and fall, re-evaluate.
 - (1) If chest does not rise, reposition head.
 - (2) If air is escaping from under the mask, reposition fingers and mask.
 - (3) Check for obstruction.
 - (4) If chest still does not rise and fall, use alternative method of artificial ventilation, e.g., pocket mask, manually triggered device.
4. Use with suspected spinal trauma
- a. Immobilize head and neck, e.g., have an assistant hold head manually or use your knees to prevent movement.
 - b. After opening airway, (using spinal precautions), Insert appropriate sized airway adjunct
 - c. Select the correct mask size (adult, child or infant).
 - d. Connect bag to mask and oxygen if not already done.
 - e. Position thumbs over top half of mask, index and middle fingers over bottom half.
 - f. Place apex of mask over bridge of nose, then lower mask over mouth and upper chin. If mask has large round cuff surrounding a ventilation port, center port over mouth.
 - g. Use ring and little fingers to bring jaw up to mask Without tilting head or neck.
 - h. Have assistant squeeze bag with two hands until chest rises.
 - i. Repeat every 5 seconds for adults and every 3 seconds for children and infants, continuing to hold jaw up without moving head or neck.
 - j. If chest does not rise, re evaluate.
 - (1) If abdomen rises, reposition jaw.
 - (2) If air is escaping from under the mask, reposition fingers and mask.
 - (3) Check for obstruction.
 - (4) If chest still does not rise, use alternative method of artificial ventilation, e.g., pocket mask.

- C. Flow restricted, oxygen-powered ventilation devices (Manually triggered, positive pressure device)
1. Flow restricted, oxygen-powered ventilation devices (for use in adults only) should provide
 - a. A peak flow rate of 100% oxygen at up to 40 LPM.
 - b. An inspiratory pressure relief valve that opens at approximately 60 centimeters water and vents any remaining volume to the atmosphere or ceases gas flow.
 - c. An audible alarm that sounds whenever the relief valve pressure is exceeded.
 - d. Satisfactory operation under ordinary environmental conditions and extremes of temperature.
 - d. A trigger positioned so that both hands of the CFR can remain on the mask to hold it in position.
 2. Use when **no** spinal injury is suspected
 - a. After opening airway, insert correct size oral or nasal airway and attach adult mask.
 - b. Position thumbs over top half of mask, index and middle fingers over bottom half.
 - c. Place apex of mask over bridge of nose, then lower mask over mouth and upper chin.
 - d. Use ring and little fingers to bring jaw up to mask.
 - e. Connect flow restricted, oxygen-powered ventilation device to mask if not already done.
 - f. Trigger the flow restricted, oxygen-powered ventilation device until chest rises.
 - g. Repeat every 5 seconds.
 - h. If chest does not rise, re evaluate.
 - (1) If abdomen rises, reposition head.
 - (2) If air is escaping from under the mask, reposition fingers and mask.
 - (3) If chest still does not rise, use alternative method of artificial ventilation, e.g., pocket mask.
 - (4) Check for obstruction.
 3. Use when there is spinal injury suspected.
 - a. Immobilize head and neck, e.g., have an assistant hold head manually or use your knees to prevent movement.
 - b. After opening airway (using spinal precautions), insert correct size oral or nasal airway and attach adult mask.
 - c. Position thumbs over top half of mask, index and middle fingers over bottom half.
 - d. Place apex of mask over bridge of nose, then lower mask over mouth and upper chin
 - e. Use ring and little fingers to bring jaw up to mask without tilting head or neck.

- f. Connect flow restricted, oxygen-powered ventilation device to mask, if not already done.
 - g. Trigger the flow restricted, oxygen-powered ventilation device until chest rises.
 - h. Repeat every 5 seconds.
 - i. If chest does not rise and fall, re evaluate.
 - (1) If chest does not rise and fall, reposition jaw.
 - (2) If air is escaping from under the mask, reposition fingers and mask.
 - (3) If chest still does not rise, use alternative method of artificial ventilation, e.g., pocket mask.
 - (4) Check for obstruction.
- D. Mouth to mask ventilation
- 1. Most effective CFR technique
 - 2. Most masks have a one way valve to divert the patient's exhalations.
 - 3. Masks should be transparent so that vomiting can be recognized.
 - 4. Mouth to mask ventilation is very effective since you use two hands to seal around the mask.
 - 5. Technique
 - a. If available, connect oxygen tubing to oxygen port on mask and set regulator at 15 liters per minute.
 - b. Place the mask around the patient's mouth and nose using the bridge of the nose as a guide for correct position. Mask position is critical since the wrong size mask will leak.
 - c. Seal the mask by placing the heel and thumb of each hand along the border of the mask and compressing firmly around the margin.
 - d. Place your index fingers on the portion of the mask that covers the chin.
 - g. Place your other fingers along the bony margin of the jaw and lift the jaw while performing a head tilt.
 - h. **Give one slow (1 1/2 second) breath of sufficient volume to make the chest rise (usually 800-1200 ml in the average adult).**
 - i. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
 - g. Adequate ventilation is determined by:
 - (1) Observing the chest rise and fall
 - (2) Hearing and feeling the air escape during exhalation
 - j. Continue at the proper rate
 - (1) **10-12 breaths per minute for adults with 1 1/2 - 2 second ventilation time**
 - (2) **20 breaths per minute for children and infants with 1 - 1 1/2 second inspiratory time.**

- (3) **40 breaths per minute for newborns with 1 to 1 1/2 second inspiratory time.**
- k. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.
- E. Mouth-to-barrier device
1. A barrier device should be used if available.
 2. Some rescuers may prefer to use a barrier device during ventilation.
 3. Barrier devices have no exhalation valve and air often leaks around the shield.
 4. Barrier devices should have low resistance to delivered ventilation.
 5. Technique
 - a. If ventilation is necessary, position the device over the patient's mouth and nose ensuring an adequate seal.
 - b. Keep the airway open by the head tilt-chin lift or jaw thrust maneuver.
 - c. **Give one slow (1 1/2 second) breath of sufficient volume to make the chest rise (usually 800-1200 ml in the average adult).**
 - d. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
 - e. Adequate ventilation is determined by:
 - (1) Observing the chest rise and fall
 - (2) Hearing and feeling the air escape during exhalation
 - f. Continue at the proper rate
 - (1) **10-12 breaths per minute for adults, with 1 1/2 - 2 second inspiratory time.**
 - (2) **20 breaths per minute for children and infants, with 1-1 1/2 second inspiratory time.**
 - (3) **40 breaths per minute for newborns, with 1 to 1 1/2 second inspiratory time.**
 - g. If the ventilation cannot be delivered, consider the possibility of an airway obstruction
- F. Mouth to mouth
1. The CFR must be aware of the risks of performing mouth to mouth ventilation.
 2. Quick, effective method of delivering oxygen to the non-breathing patient
 3. Ventilating a patient with your exhaled breath while making mouth to mouth contact
 4. The rescuer's exhaled air contains enough oxygen to support life.
 5. Barrier devices and face masks with one way valves are available for use during ventilation.
 6. CFRs should always use these devices rather than the mouth to mouth technique.
 7. Mouth to mask/barrier device does not replace training in mouth to mouth ventilation.

8. The decision to perform mouth to mouth ventilation by CFRs is a personal choice. Whenever possible, a barrier device or mouth to mask should be used.
9. Technique
 - a. Keep the airway open by the head tilt-chin lift or jaw thrust maneuver.
 - b. Gently squeeze the patient's nostrils closed with the thumb and index finger of your hand on the patient's forehead.
 - c. When ventilating an infants, cover the infants mouth and nose.
 - d. Take a deep breath and seal your lips to the patient's mouth, creating an airtight seal.
 - e. **Give one slow (1 1/2-2 second) breath of sufficient volume to make the chest rise.**
 - (1) Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
 - (2) Adequate ventilation is determined by:
 - (a) Observing the chest rise and fall
 - (b) Hearing and feeling the air escape during exhalation
 - f. Continue at the proper rate
 - (1) **12 breaths per minute for adults**
 - (2) **20 breaths per minute for children and infants**
 - (3) **40 breaths per minute for newborns**
 - g. If the ventilation cannot be delivered, consider the possibility of an airway obstruction

VIII. Clearing the Compromised Airway and Maintaining the Open Airway

- A. There are three ways that CFRs can clear or maintain an airway.
- B. These techniques are not sequential; the situation will dictate which technique is most appropriate.
- C. There are three methods of clearing the airway.
 1. The Recovery Position
 - a. The first step in maintaining an open airway
 - b. Uses gravity to keep the airway clear.
 - c. The airway is likely to remain open in this position.
 - d. Unrecognized airway obstructions are less likely to occur.
 - e. Monitor the patient until additional EMS resources arrive and assume care.
 - f. Allows fluids to drain from the mouth and not into the airway.
 - g. Used in unresponsive, uninjured patient, breathing adequately
 - h. Technique
 - (1) Place the patient's left arm straight out from his/her body and cross the patient's right leg over the left.
 - (2) Support the face and grasp the patient's right shoulder.

- (3) Roll the patient toward you onto his or her left side.
 - (4) Place the patient's right hand under the side of his/her face.
 - (5) The patient's head, torso, and shoulders should move simultaneously without twisting.
 - (6) The head should be in as close to a midline position as possible.
2. Finger sweeps
- a. Uses your fingers to remove solid objects from the airway.
 - b. Use body substance isolation.
 - c. If foreign material or vomit is visible in the mouth, it should be removed.
 - d. Do this quickly.
 - e. Blind finger sweeps should not be performed in infants or children.
 - f. Technique
 - (1) If uninjured, roll the patient to their side
 - (2) Liquids or semi-liquids should be wiped out with the index and middle fingers covered with a cloth.
 - (3) Solid objects should be removed with a hooked index finger.
3. Suctioning
- a. Uses negative pressure to keep the airway clear.
 - b. A patient needs to be suctioned immediately when a gurgling sound is heard during breathing or ventilation.
 - c. ***Suction is only indicated if the recovery position and finger sweeps are ineffective in draining the airway or trauma is suspected and the patient cannot be placed in the recovery position.***
 - d. Purpose is to remove blood, other liquids, and food particles from the airway.
 - e. Most suction units are inadequate for removing solid objects like teeth, foreign bodies, and food.
 - f. Portable suction equipment is available and may be manually or electrically operated.
 - g. Principles
 - (1) Observe body substance isolation.
 - (2) A hard or rigid "tonsil sucker" or "tonsil tip" is preferred to suction the mouth of an unresponsive patient.
 - (3) The tip of the suction catheter should not be inserted deeper than the base of the tongue.
 - (4) Because air and oxygen are removed during suction, it is recommended that you suction for no more than 15 seconds at a time, unless additional suctioning is necessary to clear the airway.

- (a) **Decrease the time in infants and children.**
- (b) **Infants 5 seconds**
- (c) **Children 10 seconds**
- (5) Watch for decreased heart rate in infants.
- (6) If a decrease in heart rate is noted, stop suctioning and provide ventilation.

IX. Foreign Body Airway Obstructions (FBAO) in the Adult

- A. Can be the cause of cardiac arrest
 - 1. Choking/food
 - 2. Bleeding into the airway
 - 3. Vomit
- B. Can be the result of cardiac arrest
 - 1. Vomiting
 - 2. Dentures
 - 3. Trauma
 - 4. Tongue
- C. Types of airway obstructions
 - 1. Partial airway obstruction
 - a. Good air exchange
 - (1) Patient remains responsive
 - (2) May be able to speak
 - (3) Can cough forcefully
 - (4) May be wheezing between coughs
 - b. Poor air exchange
 - (1) Weak ineffective cough
 - (2) High-pitched noise on inhalation
 - (3) Increased respiratory difficulty
 - (4) Possibly cyanotic
 - 2. Complete airway obstruction
 - a. No air can be exchanged.
 - b. Patient will be unable to speak, breathe, or cough.
 - c. Patient may clutch the neck with thumb and fingers--the universal distress signal.
 - d. Death will follow rapidly if prompt action is not taken.
- D. Management of the Obstructed Airway
 - Refer to Nationally Approved Guidelines for the Management of Foreign Body Airway Obstruction - SEE APPENDICES B and C.**
 - 1. Partial with good air exchange
 - 2. Partial with poor air exchange or complete airway obstructions

X. Foreign Body Airway Obstructions in infants and Children

- A. More than 90% of childhood deaths from FBAO are in children below the age of 5.
- B. 65% of the patients are infants.
- C. FBAO in children is caused by

1. Toys
 2. Balloons
 3. Small objects
 4. Food (hot dogs, round candies, nuts, and grapes)
- D. Should be suspected in infants and children who demonstrate a sudden onset of respiratory distress associated with coughing, gagging, stridor, or wheezing.
- E. Airway obstructions may be caused by infection.
- F. The CFR should only attempt to clear a complete or partial airway obstruction with poor air exchange
- G. Blind finger sweeps are not done in infants or children.
- H. Management of foreign body airway obstructions in infants
Refer to current Nationally Approved Guidelines for Foreign Body Airway Obstruction
- I. Management of foreign body airway obstructions in children
- XI. Special Considerations
- A. ***Patients with stomas***
1. Persons who have undergone a laryngectomy (surgical removal of the voice box) have a permanent opening (stoma) that connects the trachea to the front of the neck.
 2. When such person requires rescue breathing, mouth to stoma ventilations are required.
 3. Technique
 - a. Make an airtight seal around the stoma. Use a barrier device, if possible.
 - b. Deliver a ventilation slowly, allowing the chest to rise.
 - c. After delivering the ventilation, allow time for adequate exhalation.
 4. Mask to stoma or tracheostomy tube
 1. Definition of tracheostomy - an artificial permanent opening in the trachea.
 2. If unable to artificially ventilate, try suction, then artificial ventilation through mouth and nose; sealing stoma may improve ability to artificially ventilate from above or may clear obstruction.
 3. Need to seal the mouth and nose when air is escaping when artificially ventilating at the stoma.
 5. Bag-valve mask to stoma - use infant and child mask to make seal. Technique otherwise very similar to artificially ventilating through mouth. Head and neck do not need to be positioned.
 6. Some patients have partial laryngectomies. If, upon ventilating stoma, air escapes from the mouth or nose, close the mouth and pinch the nostrils.
- B. Infant and child patients

1. Place an infant's head in neutral position, but extend a little past neutral if the patient is a child.
 2. Avoid excessive hyperextension of the head.
 3. An oral airway may be considered when other procedures fail to provide a clear airway.
 4. Gastric distension is more common in children.
 5. Gastric distension may significantly impair ventilation attempts in children.
- C. Dental appliances
1. Dentures - ordinarily dentures should be left in place.
 2. Partial dentures (plates) may become dislodged during an emergency. Leave in place, but be prepared to remove it if it becomes dislodged.
- XII. Oxygen
- A. Oxygen cylinders
1. Different sizes
 - a. D cylinder has 350 liters
 - b. E cylinder has 625 liters
 - c. M cylinder has 3,000 liters
 - d. G cylinder has 5,300 liters
 - e. H cylinder has 6,900 liters
 2. Need to handle carefully since their contents are under pressure.
 3. Tanks should be positioned to prevent falling and blows to the valve gauge assembly and secured during transport.
- B. Pressure regulators
1. Full tank approximately 2000 psi. Varies with ambient temperature.
 2. Dry oxygen not harmful in short term; humidifier needed only for patient on oxygen for a long time.
- C. Operating procedures
1. Remove protective seal.
 2. Quickly open, then shut the valve.
 3. Attach regulator-flowmeter to tank.
 4. Open and close oxygen tank valve to check for leaks and pressure.
 5. Attach oxygen device to flowmeter.
 6. Open flowmeter to desired setting.
 7. Apply oxygen device to patient.
 8. When complete, remove device from patient, then turn off valve and remove all pressure from the regulator.
- D. Equipment for oxygen delivery
1. Nonrebreather mask
 - a. Preferred method of giving oxygen to prehospital patients.
 - b. Up to 90% oxygen can be delivered.

- c. Nonrebreather bag must be full before mask is placed on patient.
 - d. Flow rate should be adjusted so that when patient inhales, the bag does not collapse (15 LPM).
 - e. Patients who are cyanotic, cool, clammy or short of breath need oxygen. Concerns about the dangers of giving too much oxygen to patients with history of chronic obstructive pulmonary disease and infants and children have not been shown to be valid in the prehospital setting. Patients with chronic obstructive pulmonary disease and infants and children who require oxygen should receive high concentration oxygen.
 - f. Masks come in different sizes for adult, children and infants. Be sure to select the correct size mask.
2. Nasal cannula
 - a. Rarely the best method of delivering adequate oxygen to the prehospital patient.
 - b. Should be used only when patients will not tolerate a nonrebreather mask, despite encouragement, explanation and instruction from the CFR.

Application

Procedural (How)

1. Show diagrams of the airway and respiratory system of adults, children, and infants.
2. Show examples of adequate breathing.
3. Show examples of inadequate breathing.
4. Demonstrate the head-tilt chin lift method of opening the airway.
5. Demonstrate the jaw thrust method of opening the airway.
6. Demonstrate mouth-to-mouth ventilation of a patient, using a barrier device.
7. Demonstrate ventilation of a patient with a pocket mask.
8. Demonstrate assembly of a bag-valve-mask.
9. Use a bag-valve-mask to demonstrate artificial ventilation of a non-spine-injured patient, with and without assistance.
10. Use a bag-valve-mask to demonstrate artificial ventilation of a suspected spinal injured patient, with and without assistance
11. Demonstrate artificial ventilation of a non-spine-injured patient. with a flow restricted, oxygen-powered ventilation device.
12. Demonstrate artificial ventilation of a spine-injured patient with a flow restricted, oxygen-powered ventilation device.
13. Demonstrate insertion of an oropharyngeal (oral) airway.
14. Demonstrate insertion of a nasopharyngeal (nasal) airway.

15. Demonstrate how to check a suction unit.
16. Demonstrate the techniques of suctioning.
17. Demonstrate use of a nasal cannula.
18. Demonstrate use of a nonrebreather mask.
19. Demonstrate correct operation of oxygen tanks and regulators
20. Demonstrate ventilation of a patient with a stoma.
21. Demonstrate ventilation of an infant or child patient.

Contextual (When, Where, Why)

Every patient must have a patent airway to survive. When the airway is obstructed, the CFR must clear it as soon as possible using the methods described in this lesson.

Once the airway has been opened, the CFR must determine if breathing is adequate. Patients with inadequate breathing must be artificially ventilated using mouth-to-mask, bag-valve-mask, a flow restricted oxygen - powered ventilation device, mouth to barrier device or mouth to mouth. If the patient has adequate breathing, the CFR must decide if oxygen is indicated. If oxygen is necessary, the CFR must select the appropriate device and follow the procedure for delivery.

Student Activities

Auditory (Hearing)

1. The student should hear abnormal airway sounds such as gurgling, snoring, stridor, and expiratory grunting.
2. The student should hear a pocket mask/barrier device used on a patient.
3. The student should hear a bag-valve-mask being used on a patient with an open airway.
4. The student should hear a bag-valve-mask being used on a patient with an obstructed airway.
5. The student should hear a flow restricted, oxygen-powered ventilation device being used on a patient with an open airway.
6. The student should hear a flow restricted, oxygen-powered ventilation device being used on a patient with an obstructed airway.
7. The student should hear suction units being operated.
8. The student should hear an oxygen tank and flowmeter in operation.

Visual (Seeing)

1. The student should see audio-visual materials of the airway and respiratory system.
2. The student should see normal breathing in other students.
3. The student should see audio-visual materials of abnormal breathing.

4. The student should see audio-visual aids or materials of patients with stomas.
5. The student should see different kinds of oral and nasal airways.
6. The student should see different devices for ventilating patients (pocket masks, barrier devices, bag-valve masks, flow restricted oxygen powered ventilation device).
7. The student should see different kinds of suction units.
8. The student should see different kinds of oxygen tanks, regulators, and flowmeters.
9. The student should see nonrebreather masks and nasal cannulas.
10. The student should see audio-visual materials of various dental appliances.

Kinesthetic (Doing)

1. The student should practice evaluating breathing for adequacy.
2. The student should practice opening the airway with the head-tilt chin-lift maneuver.
3. The student should practice opening the airway with the jaw thrust.
4. The student should practice mouth-to-mouth ventilation using a barrier device.
5. The student should practice ventilation of a patient with a pocket mask.
6. The student should practice assembly of a bag-valve-mask.
7. The student should practice using a bag-valve-mask to artificially ventilate a non-spine-injured patient (adult, child, and infant) with and without assistance.
8. The student should practice using bag-valve-mask to artificially ventilate a spine-injured patient (adult, child, and infant) with assistance.
9. The student should practice artificial ventilation of a non-spine-injured patient with flow restricted, oxygen-powered ventilation device.
10. The student should practice artificial ventilation of a spine-injured patient with flow restricted, oxygen-powered ventilation device.
11. The student should practice insertion of an oropharyngeal (oral) airway (adult, child, and infant) with and without tongue blade.
12. The student should practice insertion of a nasopharyngeal (nasal) airway.
13. The student should practice checking a suction unit
14. The student should practice suctioning.
15. The student should practice ventilating a patient with a stoma.
16. The student should practice ventilating an infant or child patient.
17. The student should practice how to clear a Foreign Body Airway Obstruction for the responsive and unresponsive adult, child, and infant.

Instructor Activities

Facilitate discussion and supervise practice. Reinforce student progress in cognitive, affective, and psychomotor domains. Redirect students having difficulty with content. (Complete remediation form).

Evaluation

Practical:

Evaluate the actions of the CFR students during role-play, practice, or other skill stations to determine their compliance with the cognitive and affective objectives and their mastery of the psychomotor objectives of this lesson.

Written:

Develop evaluation instruments, e.g., case studies, examinations, oral reviews, and handouts, to determine if the students have met the cognitive and affective objectives of this lesson.

Remediation

Identify students or groups of students who are having difficulty with this subject content. Complete remediation sheet from the instructor's course guide.

Enrichment

What is unique in the local area concerning this topic? Complete enrichment sheets from instructor's course guide and attach with lesson plan.

