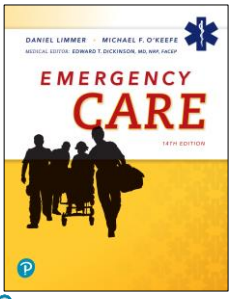
Emergency Care

Fourteenth Edition



Chapter 10

Respiration and Artificial Ventilation

Topics

Physiology and Pathophysiology

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Physiology and Pathophysiology—Mechanics of Breathing (1 of 3)

- Ventilation is the process of moving air into (inhalation) and out of (exhalation) the chest
- Inhalation is an active process
  - Chest muscles expand and the diaphragm contracts
  - The size of the chest increases
  - Negative pressure pulls air into lungs

Physiology and Pathophysiology—Mechanics of Breathing (2 of 3)

- Exhalation is a passive process
  - Chest muscles and the diaphragm relax
  - The size of the chest decreases
  - Positive pressure pushes air out of the lungs
- Tidal volume is the mount of air moved in one breath
- Minute volume is the amount of air moved into and out of the lungs per minute

Physiology and Pathophysiology—Mechanics of Breathing (3 of 3)

- Ventilation is designed to move air to and from the alveoli for gas exchange
  - Not all of the air breathed reaches the alveoli
  - Some air occupies dead space
- Alveolar ventilation refers to the amount of air that actually reaches the alveoli
  - It can be altered by changes in rate or volume
  - It depends heavily on tidal volume, but is affected by very fast or very slow rates

Physiology and Pathophysiology—Physiology of Respiration (1 of 3)

- Alveoli form the ends of the bronchiole tubes
  - Bunches of sacs are inflated and ventilated as air moves in and out
  - Each alveolus is a bubble-like structure
- Pulmonary capillaries bring blood close to the sacs
- Thin alveoli and capillary walls allow for gas exchange
  - Oxygen in the alveoli moves into the blood
  - Carbon dioxide in the blood moves into the alveoli

Physiology and Pathophysiology—Physiology of Respiration (2 of 3)

- Diffusion is movement of gases from an area of high concentration to an area of low concentration
- Pulmonary respiration is diffusion of oxygen and carbon dioxide between the alveoli and the circulating blood
- Cellular respiration is diffusion of oxygen and carbon dioxide between the cells and the circulating blood

Physiology and Pathophysiology—Physiology of Respiration (3 of 3)

- In order for pulmonary and cellular respiration to occur, the respiratory and circular systems work in conjunction
  - This is sometimes called the cardiopulmonary system
  - It may also be called a ventilation-perfusion (V/Q) match
- When either the respiratory or circular system fails, the process of respiration is defeated

Physiology and Pathophysiology—Cardiopulmonary Pathophysiology (1 of 3)

- Mechanical failures of the cardiopulmonary system limit the ability of the chest to create pressure changes
  - Stab wounds allow air into the cavity and make it impossible to create negative pressure
  - Loss of nervous control makes it impossible to innervate respiratory muscles
  - Painful chest wall injuries limit chest wall movement
  - Airway problems like bronchoconstriction limit air flow

Physiology and Pathophysiology—Cardiopulmonary Pathophysiology (2 of 3)

- Interrupted gas exchange impairs the ability to diffuse oxygen and carbon dioxide
  - Low oxygen levels in outside air limit the amount of oxygen that can be inhaled
  - Diffusion problems caused by alveoli that do not work properly limit the ability to exchange gases

Physiology and Pathophysiology—Cardiopulmonary Pathophysiology (3 of 3)

- Circulation issues prevent blood from carrying enough oxygen to the cells of the body
  - Significant blood loss reduces the amount of blood circulated to the alveoli
  - Insufficient hemoglobin or hemoglobin that is not working properly limits the transport of oxygen

Respiration

Back to Topics

Respiration—Adequate and Inadequate Breathing (1 of 4)

- Brain and body cells need a steady supply of oxygen to maintain normal function
  - Hypoxia is a low level of oxygen function
  - Hypercapnia is a high level of carbon dioxide
- Assess the cardiopulmonary system by evaluating how well it is oxygenating and removing carbon dioxide

Respiration—Adequate and Inadequate Breathing (2 of 4)

- When the cardiopulmonary system fails, the body compensates for hypoxia or hypercapnia
  - Chemoreceptors stimulate the respiratory system to breathe more rapidly
  - Respiratory rate and heart rate increase and blood vessels constrict

Respiration—Adequate and Inadequate Breathing (3 of 4)

- Respiratory distress
  - Compensation is working
  - The patient has normal mental status, skin color, and oximetry readings
- Respiratory failure (inadequate breathing)
  - Compensation is not working
  - Metabolic needs of the body are not met
- Respiratory failure is a precursor to respiratory arrest

Respiration—Adequate and Inadequate Breathing (4 of 4)

- Inadequate breathing occurs when a challenge is too great for body's compensatory mechanisms
  - Rate of breathing, depth of breathing, or both fall outside of normal ranges
  - Recognition requires keen assessment skills and prompt action

Respiration—Patient Assessment (1 of 4)

- First, determine if the patient is breathing
- Second, determine whether breathing is adequate
- Signs of adequate breathing:
  - Equal expansion of the chest is seen on inhalation
  - Air is heard entering and leaving the nose, mouth, and chest
  - Air is felt moving out of the nose or mouth
  - Skin has typical coloration
  - Rate, rhythm, quality, and depth of breath are typical

Respiration—Patient Assessment (2 of 4)

- Signs of inadequate breathing:
  - Mental status is altered
  - Chest movements are absent, minimal, or uneven
  - Pulse rate is slow (children)
  - Breathing movements are limited to the abdomen
  - No air is felt or heard at the nose or mouth
  - Breath sounds are diminished or absent
  - Wheezing, crowing, stridor, gurgling, or gasping are heard during breathing

Respiration—Patient Assessment (3 of 4)

- Signs of inadequate breathing:
  - Rate of breathing is too rapid or too slow
  - Breathing is very shallow, very deep, or labored
  - Cyanosis is seen in skin, lips, tongue, ears, or nails
  - Inspirations or expirations are prolonged
  - Patient is unable to speak
  - Retractions and nasal flaring are seen (children)
  - Oxygen saturation readings are low (<95%)
  - Body position indicates distress

Respiration—Patient Assessment (4 of 4)

- Hypoxia is insufficient supply of oxygen to body tissues
  - Common causes
    - A patient is trapped in a fire
    - A patient has emphysema
    - A patient overdoses on a drug that depresses the respiratory system
    - A patient has a heart attack, stroke, or embolism
  - Signs include cyanosis and altered mental status
- Address the cause and administer oxygen

Respiration—Patient Care

- Provide artificial ventilation to the nonbreathing patient and the patient with inadequate breathing
- Provide supplemental oxygen to the breathing patient
- Intervene when you see signs of inadequate breathing
  - The patient's efforts are not meeting demands
  - The condition will progress without intervention
  - It is better to be too aggressive than not aggressive enough

Positive Pressure Ventilation

Back to Topics

Positive Pressure Ventilation (1 of 2)

- Artificial ventilation is the use of positive pressure to force air or oxygen into the lungs
  - It is also called positive pressure ventilation
  - It is used when a patient has stopped breathing or has inadequate breathing
- Positive pressure relies on a force that is exactly the opposite of the force the body normally uses

Positive Pressure Ventilation (2 of 2)

- Use of positive pressure has negative side effects:
  - Cardiac output and blood pressure drop because the heart's ability to refill its chambers is affected
  - Gastric distention occurs because air may be diverted into the stomach
  - Hyperventilation blows off too much carbon dioxide and leads to vasoconstriction

Positive Pressure Ventilation— Techniques of Artificial Ventilation (1 of 33)

- Three methods are common:
  - Mouth-to-mask
  - Two-rescuer bag-valve mask
  - One-rescuer bag-valve mask
- Never ventilate a patient who is vomiting or has vomitus in the airway because the vomit will go into the lungs

Positive Pressure Ventilation— Techniques of Artificial Ventilation (2 of 33)

- To ensure adequate ventilations:
  - Watch the chest rise and fall with each ventilation
  - Ensure the rate of ventilation is sufficient
- Inadequate ventilations occur when the chest does move, air escapes, or the rate is too fast or slow
- Techniques should always ensure adequate protection from the patient's body fluids
  - Do not use mouth-to-mouth ventilation
  - Do use a barrier device

Positive Pressure Ventilation— Techniques of Artificial Ventilation (3 of 33)

- When ventilating a patient who is breathing rapidly:
  - Carefully assess the adequacy of respiration
  - Explain the procedure to patient
  - Place the mask over the patient's mouth and nose
  - After sealing the mask on patient's face, squeeze the bag with the patient's inhalation
  - Adjust rate over the next few breaths to ventilate fewer times with greater volume

Positive Pressure Ventilation— Techniques of Artificial Ventilation (4 of 33)

- When ventilating a patient who is breathing slowly:
  - Carefully assess the adequacy of respiration
  - Explain the procedure to patient
  - Place the mask over the patient's mouth and nose
  - After sealing the mask on patient's face, squeeze the bag with the patient's inhalation
  - Add ventilation in between the patient's own to increase the rate to 12 per minute

Positive Pressure Ventilation— Techniques of Artificial Ventilation (5 of 33)

- Opening the airway
  - Clear, suction, and position the airway
  - Head-elevated, sniffing position is optimal
    - Flex the neck forward
    - Extend the head at the top of the neck
    - Suprasternal notch is even with the ear hole and face is parallel with the ceiling
  - Adjust padding based on the patient's anatomy
  - Young pediatric patients are challenging to position

Positive Pressure Ventilation—Techniques of Artificial Ventilation (6 of 33)

- Opening the airway
  - Use the ramp position with obese patients
    - Raise the torso to a 45-degree angle
    - Plateau the head at the top of the ramp
    - Suprasternal notch is even with the ear hole and face is parallel with the ceiling
  - Ventilate spine injury patients with the head in a neutral position if possible

Positive Pressure Ventilation—Techniques of Artificial Ventilation (7 of 33)

- Sealing the mask
  - A proper seal allows air to move into the lungs
    - The mask should extend from the bridge of the nose to the cleft of the chin
    - The mask should be wide enough to cover the entire mouth
    - Two hands should be used to create a seal

Positive Pressure Ventilation—Techniques of Artificial Ventilation (8 of 33)

- Sealing the mask
  - Patient characteristics can make it hard to get a seal
    - Large, bushy beards should be wetted with water or water-soluble lubricant
    - Dentures should be left in place
- Several things can optimize mask use:
  - Raising the patient's head at a 30-degree angle
  - Using an airway adjunct
  - Using a team to ventilate

Positive Pressure Ventilation—Techniques of Artificial Ventilation (9 of 33)

- Mouth-to mask ventilation is performed using a pocket face mask
  - Masks are made of soft, collapsible plastic
  - They have infection control features
  - They may have oxygen inlets
  - They are made of clear plastic that allows observation of the patient's mouth and lips
  - They may have a strap to put around the patient's head

Positive Pressure Ventilation—Techniques of Artificial Ventilation (10 of 33)

Pocket face mask. © **Laerdal Corporation**

Positive Pressure Ventilation—Techniques of Artificial Ventilation (11 of 33)

- Mouth-to-mask for a patient without spine injury
  - EMT at the top of the patient's head

1. Position yourself directly above the patient's head
2. Place the patient in a head-elevated, sniffing position and insert an adjunct
3. Apply the mask to the patient
4. Thumbs over the top of the mask, index fingers over the bottom of the mask, and fingers under the jaw

Positive Pressure Ventilation—Techniques of Artificial Ventilation (12 of 33)

- Mouth-to-mask for a patient without spine injury
  - EMT at the top of the patient's head
    5. Lift the jaw to the mask as you tilt patient's head backward and place remaining under the jaw
    6. While lifting the jaw, squeeze the mask with your thumbs to achieve a seal
    7. Give breaths into one-way valve and watch for the chest to rise

Positive Pressure Ventilation—Techniques of Artificial Ventilation (13 of 33)

Use only a pocket mask with a one-way valve

Positive Pressure Ventilation—Techniques of Artificial Ventilation (14 of 33)

- Mouth-to-mask for a patient without spine injury
  - EMT beside the patient's head
    1. Position yourself beside the patient's head
    2. Place the patient in a head-elevated, sniffing position and insert an adjunct
    3. Apply the mask to the patient
    4. Place index finger and thumb of hand toward the top of the head along the top border of the mask

Positive Pressure Ventilation—Techniques of Artificial Ventilation (15 of 33)

- Mouth-to-mask for a patient without spine injury
  - EMT beside the patient's head
    5. Place thumb of hand toward the feet on the lower margin of the mask and fingers along the jaw
    6. Lift the jaw while performing a head-tilt, chin-lift maneuver
    7. Compress the mask against the face
    8. Give breaths into one-way valve and watch for the chest to rise

Positive Pressure Ventilation—Techniques of Artificial Ventilation (16 of 33)

- Mouth-to-mask for a patient with spine injury
  - EMT at the top of the patient's head
    1. Position yourself directly above the patient's head
    2. Place the patient in a head-elevated, sniffing position and insert an adjunct
    3. Apply the mask to the patient
    4. Thumb sides of the hands along the mask to hold it on the face

Positive Pressure Ventilation—Techniques of Artificial Ventilation (17 of 33)

- Mouth-to-mask for a patient with spine injury
  - EMT at the top of the patient's head
    5. Lift the angle of the jaw but do not tilt the head backward
    6. While lifting the jaw, squeeze the mask with your thumbs and fingers to seal
    7. Give breaths into one-way valve and watch for the chest to rise

Positive Pressure Ventilation—Techniques of Artificial Ventilation (18 of 33)

- Bag-valve masks (BVM) are used to ventilate nonbreathing patients or to assist patients in respiratory failure
- They provide an infection-control barrier
- They come in adult, child, and infant sizes
- They consist of a self-refilling shell and a non-jam valve that allows an oxygen inlet of 15 liters per minute

Positive Pressure Ventilation—Techniques of Artificial Ventilation (19 of 33)

Adult, child, and infant bag-valve-mask units.

Positive Pressure Ventilation—Techniques of Artificial Ventilation (20 of 33)

- Mechanical workings of BVM
  - Oxygen is attached and enters the reservoir
  - When squeezed, the air inlet closes and oxygen is delivered to the patient
  - When released, the patient passively expires
  - As the patient exhales, oxygen enters the reservoir

Positive Pressure Ventilation—Techniques of Artificial Ventilation (21 of 33)

- Two-rescuer BVM ventilation—no trauma suspected

1. Place the patient is the head-elevated, sniffing position and insert adjunct
2. Select correct BVM size
3. Kneel at the patient's head; position thumbs along the side of the mask and press the mask downward
4. Place the apex of the triangular mask over the bridge of the nose; lower the mask over the mouth chin

Positive Pressure Ventilation—Techniques of Artificial Ventilation (22 of 33)

- Two-rescuer BVM ventilation—no trauma suspected

5. Use the index, middle, and ring fingers to bring the jaw up to the mask; maintain head position
6. Second rescuer connects and squeezes the bag until the chest begins to rise
7. Second rescuer releases bag and lets the patient exhale passively

Positive Pressure Ventilation—Techniques of Artificial Ventilation (23 of 33)

- Two-rescuer BVM ventilation—spine injury suspected

1. Place the patient is the head-elevated, sniffing position or neutral position and insert adjunct
2. Select correct BVM size
3. Kneel at the patient's head; position thumbs along the side of the mask and press the mask downward
4. Use the index, middle, and ring fingers to bring the jaw up to the mask without tilting the head or neck
5. Second rescuer squeezes the bag as for a nonspine-injured patient

Positive Pressure Ventilation—Techniques of Artificial Ventilation (24 of 33)

For long description, see slide 115: Appendix 1

Delivering two-rescuer BVM ventilation while providing manual stabilization of the head and neck when trauma is suspected in the patient.

Positive Pressure Ventilation—Techniques of Artificial Ventilation (25 of 33)

- One-rescuer BVM ventilation
  1. Place the patient in the head-elevated, sniffing position and insert adjunct
  2. Select correct size mask and position on the face as for the two-rescuer technique
  3. Form a “C” around the ventilation port with the thumb and index finger; use the middle and little fingers to hold the jaw to mask

Positive Pressure Ventilation—Techniques of Artificial Ventilation (26 of 33)

- One-rescuer BVM ventilation
  4. Squeeze the bag with the other hand; the squeeze should cause the chest to rise
  5. Release the pressure on the bag and let the patient exhale passively

Positive Pressure Ventilation—Techniques of Artificial Ventilation (27 of 33)

- If the chest does not rise and fall during BVM ventilation:
  1. Reposition head
  2. Check for escape of air around the mask and reposition your fingers and the mask
  3. Check for airway obstruction or obstruction in BVM system and resuction if needed
- If none of these work, use an alternative method of artificial ventilation

Positive Pressure Ventilation—Techniques of Artificial Ventilation (28 of 33)

- The BVM may be used during CPR
  - The bag is squeezed once every time a ventilation is to be delivered
  - In one-rescuer CPR, it is preferred to use a pocket mask with supplemental oxygen over a BVM

Positive Pressure Ventilation—Techniques of Artificial Ventilation (29 of 33)

- Artificial ventilation of a stoma breather
  1. Clear any mucus plugs or secretions from stoma
  2. Leave the head and neck in the neutral position
  3. Use a pediatric-sized mask to establish a seal around the stoma
  4. Ventilate at the appropriate rate for the patient’s age
  5. If unable to ventilate through stoma, seal the stoma and attempt ventilation through the mouth and nose

Positive Pressure Ventilation—Techniques of Artificial Ventilation (30 of 33)

- Improper ventilation rates can harm the patient
  - Too slow can cause hypoventilation and hypoxia
  - Too fast can cause hyperventilation and vasoconstriction
- If possible, one rescuer should focus on ventilation while the other focuses on maintaining the airway and seal
- Adults should be ventilated 10–12 times per minute
- Children should be ventilated 12–20 times per minute

Positive Pressure Ventilation—Techniques of Artificial Ventilation (31 of 33)

- Improper ventilation volume can also harm the patient
  - Too much pressure causes gastric distention
  - Too much volume can cause lung tissue trauma
- Pressure should be slow and gentle
- One hand or 2–3 fingers can be used to squeeze
- Ventilations should be delivered over 1 second
- Ventilate only until the chest begins to move—do not ventilated to full expansion

Positive Pressure Ventilation—Techniques of Artificial Ventilation (32 of 33)

- An automatic transport ventilator (ATV) provides positive pressure ventilations during respiratory arrest
- It has settings for rate and volume
- It is easily portable
- It may be beneficial when prolonged ventilation is necessary and there is only one rescuer available
- The provider must ensure the respiratory rate is appropriate for the patient's size and condition and ensure a proper mask seal

Positive Pressure Ventilation—Techniques of Artificial Ventilation (33 of 33)

An automatic transport ventilator. The coin is shown for scale.
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Oxygen Therapy

Back to Topics

Oxygen Therapy—Importance of Supplemental Oxygen

- Oxygen is an important and beneficial treatment
- There are three major issues with supplemental oxygen:
  - Oxygen is a drug—It is possible to give too much or too little of it
  - Oxygen can cause harm—It can cause damage to heart attack and stroke patients
  - Oxygen administration is based on evaluation—Saturation below 94, hypoxia, and decompensation all suggest it is necessary
- Always ventilate cardiac arrest patients

Oxygen Therapy—Oxygen Therapy Equipment (1 of 13)

- Oxygen equipment in the field must be safe, lightweight, portable, and dependable
- Most systems contain cylinders, pressure regulates, and a delivery device
- Other devices like BVM and pocket masks can be used to force oxygen into the patient's lungs

Oxygen Therapy—Oxygen Therapy Equipment (2 of 13)

- Cylinders are seamless steel or alloy canisters filled with oxygen under pressure
- They come in various sizes identified by letter
  - D cylinder = 350 liters of oxygen
  - E cylinder = 625 liters of oxygen
  - M cylinder = 3,000 liters of oxygen
  - G cylinder = 5,300 liters of oxygen
  - H cylinder = 6,900 liters of oxygen
- They are green or green and white

Oxygen Therapy—Oxygen Therapy Equipment (3 of 13)

Larger cylinders are used for fixed systems on ambulances.

Oxygen Therapy—Oxygen Therapy Equipment (4 of 13)

- Cylinder safety
  - Always use pressure gauges, regulators, and tubing intended for use with oxygen
  - Always use nonferrous wrenches
  - Always ensure valve seat inserts and gaskets are in good condition
  - Always use medical-grade oxygen
  - Always open the valve fully then close it half a turn to prevent someone trying to force the valve

Oxygen Therapy—Oxygen Therapy Equipment (5 of 13)

- Cylinder safety
  - Always store reserve cylinders in a cool, ventilated room, properly secured in place
  - Always have oxygen cylinders hydrostatically tested every five years
  - Never drop a cylinder or let it fall against any object
  - Never leave an oxygen cylinder standing in an upright position without being secured.
  - Never allow smoking around oxygen equipment in use

Oxygen Therapy—Oxygen Therapy Equipment (6 of 13)

- Cylinder safety
  - Never use oxygen equipment around an open flame
  - Never use grease, oil, or fat-based soaps on devices that will be attached to a cylinder
  - Never use adhesive tape on a cylinder
  - Never try to move an oxygen cylinder by dragging it or rolling it on its side or bottom

Oxygen Therapy—Oxygen Therapy Equipment (7 of 13)

For safety, to prevent them from tipping over, oxygen cylinders must be placed in a horizontal position or, if upright, must be securely supported.

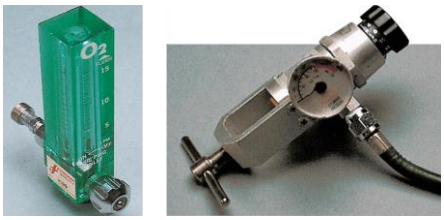
Oxygen Therapy—Oxygen Therapy Equipment (8 of 13)

- A pressure regulator must be connected to a cylinder to provide a safe working pressure of 30 to 70 psi
  - On cylinders E size or smaller, the regulator is secured using a yoke assembly
  - On cylinders larger than E size, the regulator is secured with a threaded outlet
- Before connecting a regulator to a cylinder, open the main valve slightly to clear dirt and dust

Oxygen Therapy—Oxygen Therapy Equipment (9 of 13)

- Flowmeters allow control of the flow of oxygen in liters per minute
- There are two types of low-pressure flowmeters
  - Pressure-compensated flowmeters are used for larger cylinders in the ambulance
  - Constant flow selector valve can be used with any size cylinder
- High-pressure flowmeters may be necessary for oxygen-powered devices or respirators and ventilators

Oxygen Therapy—Oxygen Therapy Equipment (10 of 13)



For long description, see slide 116: Appendix 2

Low-pressure flowmeters: (Left) A pressure-compensated flowmeter; (Right) a constant flow selector valve.

Oxygen Therapy—Oxygen Therapy Equipment (11 of 13)

High-pressure flowmeter. High-pressure oxygen is delivered through hoses attached to a threaded connector.

Oxygen Therapy—Oxygen Therapy Equipment (12 of 13)

- Humidifiers can be connected to the flowmeter to moisten dry oxygen from the cylinder
  - They are basically a non-breakable jar of water that the oxygen bubbles through
  - They must be kept clean
- Humidifiers are often not used by EMS because transports are short and they increase infection risk

Oxygen Therapy—Oxygen Therapy Equipment (13 of 13)

Humidifier in use on board an ambulance.

Oxygen Therapy—Hazards of Oxygen Therapy (1 of 2)

- Nonmedical hazards are extremely rare and can be avoided by treating equipment properly
  - If a tank is punctured or a valve breaks off, the supply tank can become a missile.
  - Oxygen can cause fire to burn more rapidly
  - Oxygen under pressure and oil create a severe, explosive reaction

Oxygen Therapy—Hazards of Oxygen Therapy (2 of 2)

- Medical hazards can occur but take time to develop and are rarely seen by EMTs
  - Oxygen toxicity or air sac collapse occurs when there is an "overload" of oxygen
  - Eye damage may occur when premature infants receive oxygen over a long period
  - Respiratory depression or respiratory arrest occur when hypoxic drive is depressed in COPD patients
  - Underlying conditions can be exacerbated, as with myocardial infarction or stroke

Oxygen Therapy—Administering Oxygen

- Various delivery devices are available
- Work with your instructor or follow your instructor's directions to understand how to use specific equipment

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (1 of 14)

- Supplemental oxygen should be used when there is shortness of breath, hypoxia, or low oxygen saturation
  - For mild distress, administer low-concentration oxygen via nasal cannula
  - For moderate to severe distress, administer high-concentration oxygen via nonrebreather mask
  - Local protocols may offer additional guidance

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (2 of 14)

- A nonrebreather mask is the best way to deliver high concentrations of oxygen to breathing patients
  - It must be placed properly on the face to provide the necessary seal
  - You must inflate the reservoir bag before putting the mask on the patient's face
- The reservoir must always contain enough oxygen so it does not deflate by more than one-third
  - This is maintained at a flow of 15 liter per minute
  - This provides concentrations from 80 to 90 percent

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (3 of 14)

- Exhaled air escapes through a flutter valve and does not return to the reservoir
- A safety feature is an emergency port that enables the patient to receive atmospheric air if the oxygen fails
- Nonrebreather masks should be used in patients with signs of hypoxia with shortness of breath, chest pain, and altered mental status

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (4 of 14)

Nonrebreather mask. Note the round disks—flutter valves that allow air exhaled by the patient to escape so it is not rebreathed.

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (5 of 14)

Nonrebreather mask. Note the round disks—flutter valves that allow air exhaled by the patient to escape so it is not rebreathed.

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (6 of 14)

- A nasal cannula provides low concentrations of oxygen (24 to 44 percent)
  - Oxygen is delivered by two prongs in the nostrils
  - Cannula is held in place by placing tubing over the ears and using a slip-loop under the chin
  - Oxygen delivered by the cannula should not exceed 4 to 6 liters per minute
- The cannula is the best choice for a patient who refuses to wear an oxygen face mask

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (7 of 14)

Nasal cannula

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (8 of 14)

- A partial rebreather mask is very similar to nonrebreather mask
  - It does not have a one-way valve like the nonrebreather mask
  - It allows the patient to rebreathe about one-third of the exhaled air
  - This is useful to preserve carbon dioxide levels to stimulate breathing
- The partial rebreather mask delivers 40 to 60 percent oxygen at 9–10 liters per minute

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (9 of 14)

- A Venturi mask delivers specific concentrations of oxygen by mixing oxygen with inhaled air
  - Mask package contains different tips that provide different concentrations of oxygen
  - Most commonly used on COPD patients

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (10 of 14)

Venturi mask

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (11 of 14)

Venturi mask

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (12 of 14)

- A tracheostomy mask is placed over a stoma or tracheostomy tube to provide supplemental oxygen
  - It is typically a small, cuplike mask that fits over the tracheostomy
  - It is connected to 8 to 10 liters per minute of oxygen via supply tubing

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (13 of 14)

Tracheostomy mask

Oxygen Therapy—Supplemental Oxygen for Patients with Chest Pain (14 of 14)

- High-concentration oxygen should be administered to children in respiratory distress, with inadequate respirations, or in possible shock
- Infants and children may benefit from the blow-by technique
  - Hold tubing or a nonrebreather mask 2 inches from the face
  - Oxygen passes over the face and is inhaled

Special Considerations

Back to Topics

Special Considerations (1 of 4)

- Facial injuries
  - Bleeding may require frequent suctioning
  - An airway adjunct or endotracheal tube may be needed
- Obstructions
  - Suction units are not adequate for removing solid objects
  - Use abdominal thrusts, chest thrusts, or finger sweeps

Special Considerations (2 of 4)

- Dental appliances
  - Dentures should be left in place during airway procedures
  - Partial dentures may become dislodged during an emergency
  - Be prepared to remove a device if it endangers the airway

Special Considerations (3 of 4)

- Infants and children
  - Anatomic considerations
    - The tongue takes up more space
    - The trachea is softer and more flexible and the head is proportionately larger
    - Chest wall is softer and diaphragm breathing is more important
    - Oxygen burn rate is twice the adult rate

Special Considerations (4 of 4)

- Infants and children
  - Management considerations
    - Avoid excessive pressure and volume.
    - Use properly sized face masks.
    - Flow-restricted, oxygen-powered ventilation devices are contraindicated
    - Use pediatric-sized nonrebreather masks and nasal cannulas
    - Gastric distention may impair adequate ventilations

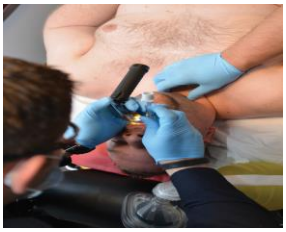
Assisting with Advanced Airway Devices

Back to Topics

Assisting with Advanced Airway Devices — Preparing the Patient for Intubation (1 of 3)

- Before a paramedic places a tube, you may be asked to give the patient extra oxygen
- The paramedic will then position the patient's head in the head-elevated, sniffing position
- The paramedic will remove the oral airway and pass the endotracheal tube into place
- You may be asked to help with the BURP maneuver

Assisting with Advanced Airway Devices — Preparing the Patient for Intubation (2 of 3)



In the BURP maneuver, press your thumb and index finger on either side of the throat over the cricoid cartilage and gently direct the throat upward and toward the patient's right. **© Edward T. Dickinson, MD**

Assisting with Advanced Airway Devices — Preparing the Patient for Intubation (3 of 3)

- Once the tube is placed, the paramedic assures proper placement via two methods
- The tube is then anchored with a commercial restraint
- You may be asked to monitor lung and epigastric sounds
- Take care not to disturb the tube once it has been placed and secured

Assisting with Advanced Airway Devices — Ventilating the Intubated Patient (1 of 2)

- Very little movement can displace an endotracheal tube
- Ventilate about 10 times per minute
- Hold the tube against the patient's teeth with two fingers of one hand
- Work the BVM with the other hand
- If ventilating a breathing patient, time ventilations with respiratory effort as much as possible

Assisting with Advanced Airway Devices — Ventilating the Intubated Patient (2 of 2)

- Pay attention to resistance to ventilations; report any changes
- If patient is defibrillated, carefully remove the bag from the tube
- Watch for any change in the patient's mental status.
- During cardiac arrest, you may be asked to remove the BVM so medication can be injected

Assisting with Advanced Airway Devices — Assisting with Trauma Intubation (1 of 2)

- Provide manual in-line stabilization throughout procedure
- The paramedic will hold manual stabilization while you apply a cervical collar
- You will then stabilize the head from the patient's side
- The paramedic will lean back, use a laryngoscope, and tube the patient

Assisting with Advanced Airway Devices — Assisting with Trauma Intubation (2 of 2)

- After intubation, you will hold the tube against the teeth until placement is confirmed
- The tube will then be anchored
- You must hold manual stabilization in addition to a collar until the head is taped in place on the backboard

Chapter Review

Chapter Review (1 of 2)

- Respiratory failure is the result of inadequate breathing, breathing that is insufficient to support life.
- A patient in respiratory failure or respiratory arrest must receive artificial ventilations.
- Oxygen can be delivered to the nonbreathing patient as a supplement to artificial ventilation.

Chapter Review (2 of 2)

- Oxygen can also be administered as therapy to the breathing patient whose breathing is inadequate or who is cyanotic, cool and clammy, short of breath, suffering chest pain, suffering severe injuries, or displaying an altered mental status.

Remember (1 of 3)

- Always use proper personal protective equipment when managing an airway.
- Assessment of breathing must be an ongoing process; respiratory status can change over time.
- Inadequate breathing requires immediate action.

Remember (2 of 3)

- Positive pressure ventilations are very different from normal breathing and can have negative side effects.
- Select the most appropriate method of positive pressure ventilations based upon the needs of the individual.

Remember (3 of 3)

- Always use appropriate safety measures when handling oxygen.
- Select the appropriate delivery device to provide supplemental oxygen.

Questions to Consider (1 of 2)

- What are the signs of respiratory distress?
- What are the signs of respiratory failure?
- For BVM ventilation, what are recommended variations in technique for one or two rescuers?

Questions to Consider (2 of 2)

- How does the way positive pressure ventilation moves air differ from how the body normally moves air?
- Describe a patient problem that would benefit from administration of oxygen and explain how to decide what oxygen delivery device should be used.

Critical Thinking (1 of 2)

- On arrival at the emergency scene, you find an adult female patient who is semiconscious. Her respiratory rate is 7 per minute. She appears pale and slightly blue around her lips.

Critical Thinking (2 of 2)

- Is this patient in respiratory failure, and if so what signs and symptoms indicate this? Does this patient require artificial ventilations?

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Appendix 1

The EMT positions the mask over the rescuer's face and forms a C position with thumb and index finger and also places the middle, ring and little fingers along the patient's jaw. Another nurse holds the bag valve connected to the oxygen mask and pumps by his two hands.

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Appendix 2

The first picture is a low pressure flow meter that is kept in upright position. The low pressure unit has a calibrated glass tube. A valve is present at the bottom of the meter. The second picture represents the slanting view of selector valve. The valve has manual regulator at the bottom. The meter is at the center of the valve and a tube is connected downward from the meter.

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