

# Chapter 9

## Airway Management

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## Anatomy of the Respiratory System (1 of 2)

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## Anatomy of the Upper Airway (1 of 7)

- Upper airway consists of:
  - Nose
  - Mouth
  - Jaw
  - Oral cavity
  - Pharynx
  - Larynx

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## Anatomy of the Upper Airway (2 of 7)

- Its main function is to **warm, filter, and humidify** air as it enters the body.
- Pharynx**
  - Muscular tube extending from nose and mouth to level of esophagus and trachea
  - Composed, from top to bottom, of the **nasopharynx, oropharynx, and laryngopharynx**

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## Anatomy of the Upper Airway (3 of 7)

- Nasopharynx**
  - Formed by the union of facial bones
  - Warms and humidifies air as it enters the body

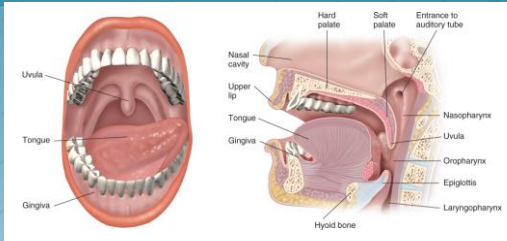
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## Anatomy of the Upper Airway (4 of 7)

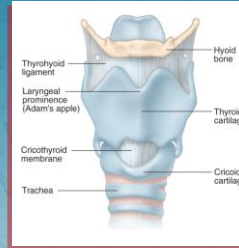
- Oropharynx**
  - Posterior portion of the oral cavity
  - Entrance for respiratory and digestive system
  - Superior to the larynx is the epiglottis.

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## Anatomy of the Upper Airway (5 of 7)



## Anatomy of the Upper Airway (6 of 7)



- **Larynx**
  - Complex structure formed by many independent cartilaginous structures
  - Marks where the upper airway ends and the lower airway begins

## Anatomy of the Upper Airway (7 of 7)

- **Larynx (cont'd)**
  - **Thyroid cartilage** forms a "V" shape anteriorly.
  - **Cricoid cartilage** forms the lowest portion of the larynx.
  - **Glottis** is the area between the vocal cords.

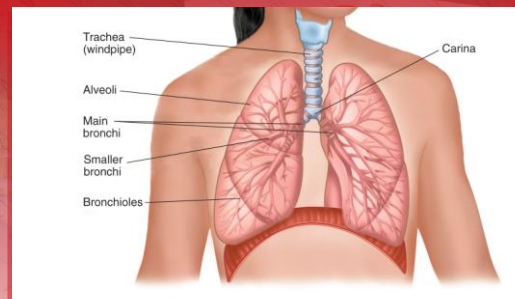
## Anatomy of the Lower Airway (1 of 6)

- Function is to exchange oxygen and carbon dioxide.
- Includes:
  - Trachea
  - Bronchi
  - Lungs

## Anatomy of the Lower Airway (2 of 6)

- **Trachea**
  - Conduit for air entry into the lungs
  - Divides at the carina into two main stem bronchi, right and left
  - Bronchi are supported by cartilage.
  - Bronchi distribute oxygen to the lungs.

## Anatomy of the Lower Airway (3 of 6)

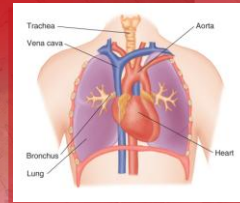


## Anatomy of the Lower Airway (4 of 6)

- Trachea (cont'd)
  - Bronchioles are made of smooth muscle and dilate and constrict as oxygen passes through them.
  - Smaller bronchioles connect to alveoli.
  - Oxygen is transported back to the heart and distributed to the rest of the body.

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## Anatomy of the Lower Airway (5 of 6)



- The heart and great vessels (vena cava and aorta) are also contained in the thoracic cavity.

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## Anatomy of the Lower Airway (6 of 6)

- The **mediastinum** is the space between the lungs, containing:
  - Heart
  - Great vessels
  - Esophagus
  - Trachea
  - Major bronchi
  - Many nerves

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## Physiology of Breathing (1 of 2)

- Respiratory and cardiovascular systems work together.
  - Ensure a constant supply of oxygen and nutrients are delivered to cells
  - Remove carbon dioxide and waste products

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## Physiology of Breathing (2 of 2)

**Table 9-1** Ventilation, Oxygenation, and Respiration

Function	Definition
Ventilation	The physical act of moving air into and out of the lungs
Oxygenation	The process of loading oxygen molecules onto hemoglobin molecules in the bloodstream
Respiration	The actual exchange of oxygen and carbon dioxide in the alveoli as well as the tissues of the body

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## Ventilation (1 of 7)

- Physical act of moving air into and out of the lungs
- Inhalation
  - Active, muscular part of breathing
  - Diaphragm and intercostal muscles contract.
  - Diaphragm acts as a voluntary and involuntary muscle.

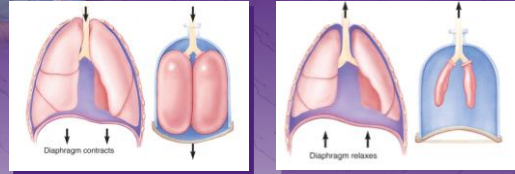
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## Ventilation (2 of 7)

- Inhalation (cont'd)
  - Lungs require the movement of the chest and supporting structures to expand.
  - Partial pressure is the amount of gas in the air or dissolved fluid (blood).
  - Oxygen and carbon dioxide both diffuse until partial pressure in the air and blood is equal.

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## Ventilation (3 of 7)



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## Ventilation (4 of 7)

- Inhalation (cont'd)
  - Inspiration focuses on delivering oxygen to alveoli.
  - Tidal volume
  - Dead space
  - Minute ventilation
  - Vital capacity
  - Residual volume

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## Ventilation (5 of 7)

- Exhalation
  - Does not normally require muscular effort
  - Passive process
  - Diaphragm and intercostal muscles relax.
  - Smaller thorax compresses air into the lungs.

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## Ventilation (6 of 7)



- Exhalation (cont'd)
  - Air can enter and leave the lungs only if it travels through the trachea.

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## Ventilation (7 of 7)

- Regulation of ventilation is primarily by the pH of the cerebrospinal fluid.
  - Directly related to the amount of carbon dioxide in the plasma
  - Failure to meet the body's need for oxygen may result in hypoxia.
  - Patients with COPD have difficulty eliminating carbon dioxide through exhalation.

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## Oxygenation

- Process of loading oxygen molecules onto hemoglobin molecules in bloodstream
- Required for internal respiration to take place
  - Does not guarantee, however, that internal respiration is taking place

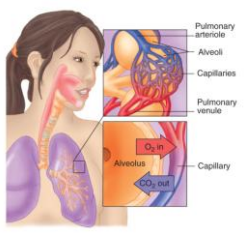
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## Respiration (1 of 4)

- Actual exchange of oxygen and carbon dioxide in the alveoli and tissues of the body
- Cells take energy from nutrients through metabolism.

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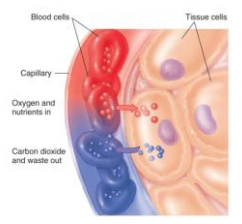
## Respiration (2 of 4)



- External respiration (pulmonary respiration)
  - Breathes fresh air into respiratory system
  - Exchanges oxygen and carbon dioxide between alveoli and blood in pulmonary capillaries

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## Respiration (3 of 4)



- Internal respiration
  - Exchange of oxygen and carbon dioxide between systemic circulatory system and cells

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## Respiration (4 of 4)

- Eventually all cells will die if deprived of oxygen.



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## Pathophysiology of Respiration (1 of 7)

- Factors in the nervous system
  - Chemoreceptors monitor levels of:
    1. pH of cerebrospinal fluid
    2. Hydrogen ions
    3. Carbon dioxide
    4. Oxygen
  - Provide feedback to the respiratory centers

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## Pathophysiology of Respiration (2 of 7)

- **Ventilation/perfusion ratio and mismatch**
  - Air and blood are meant to be directed to the same place at the same time.
  - Ventilation and perfusion must be matched.
  - Failure to match is the cause of most abnormalities of oxygen and carbon dioxide exchange.

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## Pathophysiology of Respiration (3 of 7)

- **Ventilation/perfusion ratio and mismatch (cont'd)**
  - Normal resting minute ventilation is about 6 L/min.
  - Pulmonary artery flow is approximately 5 L/min.
  - Ventilation to perfusion ratio of 4/5 L/min or 0.8 L/min.

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## Pathophysiology of Respiration (4 of 7)

- **Factors affecting pulmonary ventilation**
  - Maintaining a patent airway is critical.
  - **Intrinsic factors:**
    - Infections
    - Allergic reactions
    - Unresponsiveness (tongue obstruction)
  - **Extrinsic factors:**
    - Trauma
    - Foreign body airway obstruction

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## Pathophysiology of Respiration (5 of 7)

- **Factors affecting respiration**
  - **External factors:**
    - Decreased atmospheric pressure at high altitudes
  - **Internal factors:**
    - Pneumonia
    - COPD

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## Pathophysiology of Respiration (6 of 7)

- **Circulatory compromise**
  - Trauma emergencies typically obstruct blood flow to individual cells and tissue:
    - Pulmonary embolism
    - Tension pneumothorax
    - Open pneumothorax
    - Hemothorax
    - Hemopneumothorax

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## Pathophysiology of Respiration (7 of 7)

- **Circulatory compromise (cont'd)**
  - Other causes include:
    - Blood loss
    - Anemia
    - Hypovolemic shock
    - Vasodilatory shock

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## Patient Assessment (1 of 7)

- Recognizing adequate breathing
  - Between 12 and 20 breaths/min
  - Regular pattern of inhalation and exhalation
  - Bilateral clear and equal lung sounds
  - Regular, equal chest rise and fall
  - Adequate depth (tidal volume)

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## Patient Assessment (2 of 7)

- Recognizing abnormal breathing
  - Fewer than 12 breaths/min
  - More than 20 breaths/min
  - Irregular rhythm
  - Diminished, absent, or noisy auscultated breath sounds
  - Reduced flow of expired air at nose and mouth

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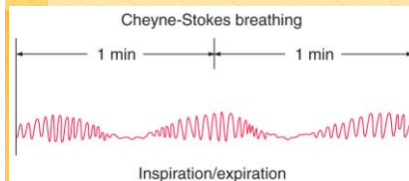
## Patient Assessment (3 of 7)

- Recognizing abnormal breathing (cont'd)
  - Unequal or inadequate chest expansion
  - Increased effort of breathing
  - Shallow depth
  - Skin that is pale, cyanotic, cool, or moist
  - Skin pulling in around ribs or above clavicles during inspiration

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## Patient Assessment (4 of 7)

- A patient may appear to be breathing after the heart has stopped.
  - Called **agonal respirations**
- **Cheyne-Stokes** respirations are often seen in stroke and head injury patients.



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## Patient Assessment (5 of 7)

- **Ataxic respirations**
  - Irregular or unidentifiable pattern
  - May follow serious head injuries
- **Kussmaul respirations**
  - Deep, gasping respirations
  - Associated with metabolic/toxic disorders
- Patients with inadequate breathing need to be treated immediately.

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## Patient Assessment (6 of 7)

- Assessment of respiration
  - Respiration is actual exchange of oxygen and carbon dioxide at tissue level.
  - Even though patient may be **ventilating appropriately**, **respiration may be compromised**.

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## Patient Assessment (7 of 7)

- Assessment of respiration (cont'd)
  - Skin color and level of consciousness are excellent indicators of respiration.
  - Also consider oxygenation.
    - Pulse oximetry is the method to assess (see **Skill Drill 9-1**).

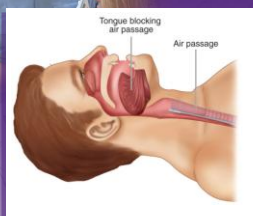
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## Opening the Airway (1 of 3)

- Emergency medical care begins with ensuring an open airway.
- Rapidly assess whether an unconscious patient has an open airway and is breathing adequately.
  - Position the patient correctly.
  - Supine position is most effective.

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## Opening the Airway (2 of 3)



- Unconscious patients should be moved as a unit.
  - See **Skill Drill 9-2**.
  - Most common airway obstruction is the tongue.

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## Opening the Airway (3 of 3)

- Other causes of airway obstruction:
  - Dentures
  - Blood
  - Vomitus
  - Mucus
  - Food
  - Other foreign objects

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## Head Tilt–Chin Lift Maneuver (1 of 3)



- Maneuver will open the airway in most patients
- For patients who have not sustained or are not suspected of having sustained trauma

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## Basic Airway Adjuncts (1 of 6)

- Prevents obstruction by the tongue and allows for passage of air and oxygen to the lungs
- Oropharyngeal airways
  - See **Skill Drills 9-3** and **9-4**.
  - Keep tongue from blocking upper airway.
  - Make it easier to suction oropharynx if necessary.

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## Basic Airway Adjuncts (2 of 6)

- **Oropharyngeal airways** (cont'd)
  - **Indications** include:
    - Unresponsive patients without a gag reflex
    - Apneic patients being ventilated with a bag-mask device
  - **Contraindications** include:
    - Conscious patients
    - Any patient who has an intact gag reflex

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## Basic Airway Adjuncts (5 of 6)

- **Nasopharyngeal airways** (cont'd)
  - **Indications:**
    - Semiconscious or unconscious patients with an intact gag reflex
    - Patients who will not tolerate an oropharyngeal airway
  - **Contraindications:**
    - Severe head injury with blood in the nose
    - History of fractured nasal bone

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## Suctioning (1 of 2)

- You must keep the airway clear to ventilate properly.
- Portable, hand-operated, and fixed equipment is essential for resuscitation.



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## Suctioning (2 of 2)

- **Portable or fixed unit should have:**
  - Wide-bore, thick-walled, nonkinking tubing
  - Plastic, rigid pharyngeal suction tips
  - Nonrigid plastic catheters
  - A nonbreakable, disposable collection bottle
  - Water supply for rinsing the tips

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## Techniques of Suctioning (2 of 5)

- Never suction the mouth or nose for more than 15 seconds at one time for adult patients, 10 seconds for children, and 5 seconds for infants.
  - Suctioning can result in hypoxia.
  - See **Skill Drill 9-6**.

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## Techniques of Suctioning (4 of 5)

- If the patient produces frothy secretions as quickly as you can suction them:
  - Suction the airway for 15 seconds (less in infants and children).
  - Ventilate for 2 minutes.
  - Continue this alternating pattern until all secretions have been cleared.

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## Maintaining the Airway (1 of 3)

- Use the recovery position.
  - Used to help maintain a clear airway in an unconscious patient who is not injured and is breathing on his or her own



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## Supplemental Oxygen (1 of 9)

- Always give to patients who are hypoxic
  - Some tissues and organs need a constant supply of oxygen to function normally.
- **Never withhold oxygen from any patient who might benefit from it.**

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## Supplemental Oxygen (3 of 9)

- Supplemental oxygen equipment
  - Become familiar with how oxygen is stored.
  - Oxygen cylinders contain compressed gas.
  - Liquid oxygen is becoming a more commonly used alternative.

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## Supplemental Oxygen (4 of 9)

- **Safety considerations**
  - Handle gas cylinders carefully.
  - Make sure the correct pressure regulator is firmly attached before transport.
  - A puncture hole in a tank can turn it into a deadly missile.
  - Secure tanks during transport.
  - [http://www.youtube.com/watch?v=f\\_xmaPSZ6GM](http://www.youtube.com/watch?v=f_xmaPSZ6GM)

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## Supplemental Oxygen (5 of 9)

- Pin-indexing system
  - Prevents such mistakes as an oxygen regulator being accidentally connected to a carbon dioxide cylinder
  - Every cylinder of a specific gas type has a given pattern and a given number of pins.

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## Supplemental Oxygen (6 of 9)

- **Pressure regulators**
  - Reduce the cylinder's pressure to a useful therapeutic range
  - Usually 40 to 70 psi
  - Final attachment for delivering the gas is either a quick-connect female fitting or a flowmeter.

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## Supplemental Oxygen (7 of 9)

- **Flowmeters**
  - Usually permanently attached to pressure regulators on emergency medical equipment
  - Pressure-compensated flowmeter
  - Bourdon-gauge flowmeter

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## Supplemental Oxygen (8 of 9)

- To place an oxygen cylinder in service, see **Skill Drill 9-7**.
- Remember that you must be completely familiar with the equipment before attempting to use it on a patient.
- Hazards of supplemental oxygen:
  - **Oxygen does not burn or explode but it speeds up the combustion process.**
    - A small spark, such as a glowing cigarette, can become a flame.

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## Supplemental Oxygen (9 of 9)

- Hazards (cont'd)
  - Keep any sources of fire away.
  - Make sure the area is adequately ventilated.
  - Never leave an oxygen cylinder standing unattended.

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## Oxygen-Delivery Equipment

- Nonbreathing masks
- Bag-mask devices
- Nasal cannulas

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## Nonbreathing Masks (1 of 2)



- Preferred way to give oxygen in the prehospital setting
  - To patients who are breathing adequately but are suspected of having hypoxia
- Combination mask and reservoir bag system

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## Nonbreathing Masks (2 of 2)

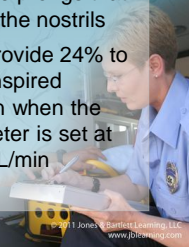
- Make sure the reservoir bag is full before placing the mask on the patient.
- Adjust the flow rate so the bag does not collapse when the patient inhales.
  - Usually 10 to 15 L/min
- When oxygen therapy is discontinued, remove the mask.

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## Nasal Cannulas (1 of 2)

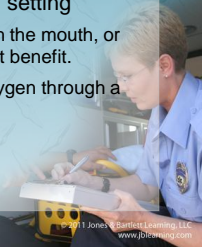


- Delivers oxygen through two small, tubelike prongs that fit into the nostrils
- Can provide 24% to 44% inspired oxygen when the flowmeter is set at 1 to 6 L/min



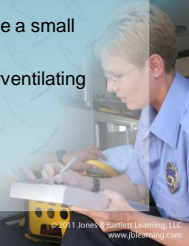
## Nasal Cannulas (2 of 2)

- When you anticipate a long transport time, consider using humidification.
- Limited use in the prehospital setting
  - A patient who breathes through the mouth, or has a nasal obstruction, will not benefit.
  - Always try to give high-flow oxygen through a nonrebreathing mask.



## Partial Rebreathing Masks

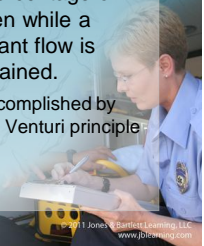
- Similar to nonrebreathing mask
  - Except no one-way valve between mask and reservoir
  - Consequently, patients rebreathe a small amount of exhaled air.
  - Advantageous if patient is hyperventilating



## Venturi Masks (1 of 2)



- A number of settings can vary the percentage of oxygen while a constant flow is maintained.
  - Accomplished by the Venturi principle



## Venturi Masks (2 of 2)

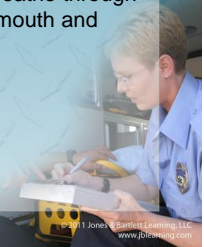
- Medium-flow device that delivers 24% to 40% oxygen
- Useful in long-term management of physiologically stable patients



## Tracheostomy Masks (1 of 2)

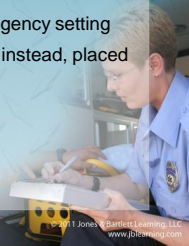


- Patients with tracheostomies do not breathe through their mouth and nose.



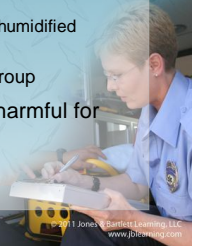
## Tracheostomy Masks (2 of 2)

- Tracheostomy masks cover the tracheostomy hole and have a strap that goes around the neck.
  - May not be available in an emergency setting
  - Improvise by using a face mask instead, placed at the tracheostomy opening.



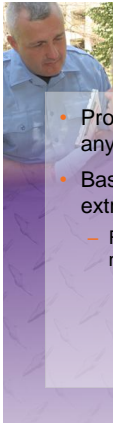
## Humidification

- Some EMS systems provide humidified oxygen.
  - During extended transport
    - Many EMS systems do not use humidified oxygen in prehospital setting.
  - For certain conditions such as croup
- Dry oxygen is not considered harmful for short-term use.



## Assisted and Artificial Ventilation (1 of 18)

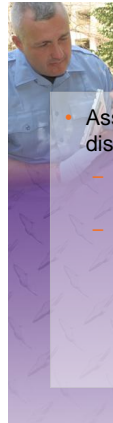
- Probably the most important skills in EMS at any level
- Basic airway and ventilation techniques are extremely effective.
  - Follow standard precautions as needed when managing a patient's airway.



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## Assisted and Artificial Ventilation (2 of 18)

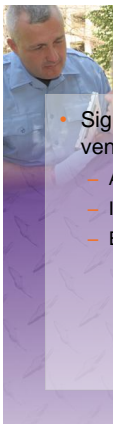
- Assisting ventilation in respiratory distress/failure
  - Intervene quickly to prevent further deterioration.
  - Two treatment options: assisted ventilation and CPAP



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## Assisted and Artificial Ventilation (3 of 18)

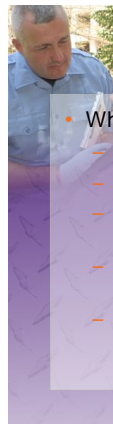
- Signs and symptoms of inadequate ventilation:
  - Altered mental status
  - Inadequate minute volume
  - Excessive accessory muscle use and fatigue



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## Assisted and Artificial Ventilation (4 of 18)

- When assisting with a bag-mask device:
  - Explain the procedure to the patient.
  - Place the mask over the nose and mouth.
  - Squeeze the bag each time the patient breathes.
  - After the initial 5 to 10 breaths, deliver an appropriate tidal volume.
  - Maintain an adequate minute volume.



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## Assisted and Artificial Ventilation (7 of 18)

- Artificial ventilation
  - Patients in respiratory arrest need immediate treatment to live.
  - Once a patient is not breathing, begin artificial ventilation immediately via:
    - Mouth-to-mask technique
    - One-, two-, or three-person bag-mask device
    - Manually triggered ventilation device

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## Assisted and Artificial Ventilation (8 of 18)

- Normal ventilation versus positive-pressure ventilation
  - In normal breathing, the diaphragm contracts and negative pressure is generated in the chest cavity.
  - Positive-pressure ventilation generated by a device (such as a bag-mask device) forces air into the chest cavity.

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## Assisted and Artificial Ventilation (9 of 18)

- With positive-pressure ventilation:
  - Increased intrathoracic pressure reduces the blood pumped by the heart.
  - More volume is required to have the same effects as normal breathing.
  - Air is forced into the stomach, causing gastric distention.

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## Assisted and Artificial Ventilation (10 of 18)

- Mouth-to-mouth and mouth-to-mask ventilation
  - Barrier device is routinely used in mouth-to-mouth ventilations
  - Mask with an oxygen inlet provides oxygen during mouth-to-mask ventilation
  - See **Skill Drill 9-8**.

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## Assisted and Artificial Ventilation (12 of 18)

- You know that you are providing adequate ventilations if:
  - Patient's color improves
  - Chest rises adequately
  - You do not meet resistance when ventilating
  - You hear and feel air escape as the patient exhales

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## Assisted and Artificial Ventilation (13 of 18)

- Bag-mask device
  - Most common method used to ventilate patients in the field
  - Provides less tidal volume than mouth-to-mask ventilation
    - Experienced EMT can provide adequate tidal volume.



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## Assisted and Artificial Ventilation (14 of 18)

- Bag-mask device (cont'd)
  - If you have difficulty adequately ventilating a patient, switch to another method.
  - Volume of oxygen delivered is based on chest rise and fall
  - Work together with your partner to provide ventilation.

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## Assisted and Artificial Ventilation (15 of 18)

- Bag-mask device (cont'd)
  - You may need to use an airway adjunct or the Sellick maneuver.
  - Be alert for gastric distention.



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## Assisted and Artificial Ventilation (16 of 18)

- Manually triggered ventilation devices
  - Also known as flow-restricted, oxygen-powered ventilation devices
  - Widely available
  - Allow single rescuer to use both hands to maintain mask-to-face seal while providing positive-pressure ventilation

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## Assisted and Artificial Ventilation (17 of 18)

- Manually triggered ventilation devices (cont'd)
  - Reduces rescuer fatigue
  - May be difficult to maintain adequate ventilation without assistance
  - Should not be used routinely
  - Should not be used with COPD or suspected cervical spine or chest injuries

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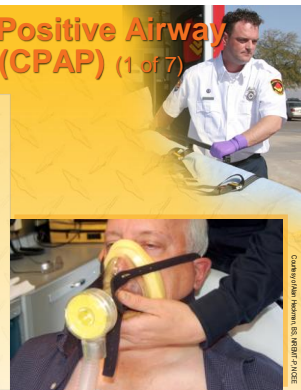
## Assisted and Artificial Ventilation (18 of 18)

- Automatic transport ventilator (ATV)
  - Manually triggered device attached to a control box
  - Allows the variables of ventilation to be set
  - Lacks the sophisticated control of a hospital ventilator
  - Frees the EMT to perform other tasks

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## Continuous Positive Airway Pressure (CPAP) (1 of 7)

- Noninvasive ventilatory support for respiratory distress
  - Many people diagnosed with obstructive sleep apnea wear a CPAP unit at night.
  - Becoming widely used at the EMT level



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## Continuous Positive Airway Pressure (CPAP) (2 of 7)

- Mechanism
  - Increases pressure in the lungs
  - Opens collapsed alveoli
  - Pushes more oxygen across the alveolar membrane
  - Forces interstitial fluid back into the pulmonary circulation

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## Continuous Positive Airway Pressure (CPAP) (3 of 7)

- Mechanism (cont'd)
  - Therapy is delivered through a face mask held to the head with a strapping system.
  - Use caution with patients with potentially low blood pressure.

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## Continuous Positive Airway Pressure (CPAP) (4 of 7)

- Indications
  - Patient is alert and able to follow commands.
  - Patient displays obvious signs of moderate to severe respiratory distress.
  - Patient is breathing rapidly.
  - Pulse oximetry reading is less than 90%.

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## Continuous Positive Airway Pressure (CPAP) (5 of 7)

- Contraindications
  - Patient in respiratory arrest
  - Signs and symptoms of pneumothorax or chest trauma
  - Patient who has a tracheostomy
  - Active gastrointestinal bleeding or vomiting
  - Patient is unable to follow verbal commands.

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## Continuous Positive Airway Pressure (CPAP) (6 of 7)

- Application
  - During the expiratory phase, the patient exhales against a resistance called positive end-expiratory pressure (PEEP).
  - 8.0 to 10.0 cm H<sub>2</sub>O is acceptable.
  - To use a CPAP, see **Skill Drill 9-9**.

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## Continuous Positive Airway Pressure (CPAP) (7 of 7)

- Complications
  - Some patients may find CPAP claustrophobic.
  - Possibility of causing a pneumothorax
  - Can lower a patient's blood pressure
  - If the patient shows signs of deterioration, remove CPAP and begin positive-pressure ventilation using a bag-mask device.

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## Special Considerations (1 of 5)

- Gastric distention
  - Occurs when artificial ventilation fills the stomach with air
  - Most commonly affects children
  - Most likely to occur when you ventilate the patient too forcefully or too rapidly
  - May also occur when the airway is obstructed

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## Special Considerations (2 of 5)

- Gastric distention (cont'd)
  - Slight gastric distention is not of concern.
  - Severe inflation of the stomach is dangerous.
  - Recheck and reposition the airway, apply cricoid pressure, and perform rescue breathing.

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## Special Considerations (3 of 5)



- Stomas and tracheostomy tubes
  - Patients who have had a laryngectomy have a permanent tracheal stoma.
  - Known as a tracheostomy

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## Special Considerations (4 of 5)

- Stomas and tracheostomy tubes (cont'd)
  - Neither the head tilt–chin lift nor the jaw-thrust maneuver is required.
  - If the patient has a tracheostomy tube, ventilate through the tube with a bag-mask device.

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## Special Considerations (5 of 5)

- Stomas and tracheostomy tubes (cont'd)
  - If the patient has a stoma but no tube is in place, use an infant or child mask with your bag-mask device to make a seal over the stoma.

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## Foreign Body Airway Obstruction (1 of 7)

- If a foreign body completely blocks the airway, it is a true emergency.
  - Will result in death if not treated immediately
  - In an adult, it usually occurs during a meal.
  - In a child, it can occur while eating, playing with small toys, or crawling.

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## Foreign Body Airway Obstruction (2 of 7)

- The tongue is the most common airway obstruction.
- Causes of airway obstruction that do not involve foreign bodies include:
  - Swelling, from infection or acute allergic reaction
  - Trauma (tissue damage from injury)

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## Foreign Body Airway Obstruction (3 of 7)

- Early recognition is crucial.
- Mild airway obstruction
  - Patients can still exchange air, but will have respiratory distress.
  - Noisy breathing, wheezing, coughing
  - With good air exchange, do not interfere with the patient's efforts to expel the object on his or her own.

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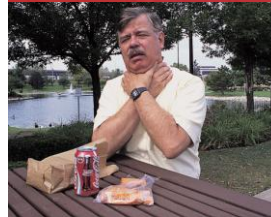
## Foreign Body Airway Obstruction (4 of 7)



- Mild airway obstruction (cont'd)
  - With poor air exchange, the patient may have increased difficulty breathing, stridor, and cyanosis.
  - Treat immediately.

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## Foreign Body Airway Obstruction (5 of 7)



- Severe airway obstruction
  - Patients cannot breathe, talk, or cough.
  - Patient may use the universal distress signal, begin to turn cyanotic, and have extreme difficulty breathing.

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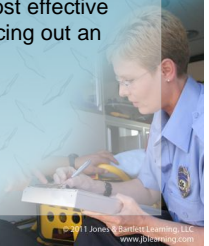
## Foreign Body Airway Obstruction (6 of 7)

- Severe airway obstruction (cont'd)
  - Provide immediate treatment to the conscious patient.
  - If not treated, the patient will become unconscious and die.
  - Any person found unconscious must be managed as if he or she has a compromised airway.

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## Emergency Medical Care for Foreign Body Airway Obstruction

- Perform a head tilt–chin lift maneuver to clear a tongue obstruction.
- Abdominal thrusts are the most effective method of dislodging and forcing out an object.



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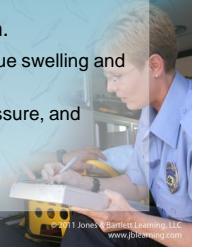
## Dental Appliances

- Can cause an airway obstruction
  - Examples: crown, bridge, dentures, piece of braces
  - Manually remove the appliance before providing ventilations.
  - Leave well-fitting dentures in place.
  - Loose dentures interfere with the process and should be removed.



## Facial Bleeding

- Airway problems can be particularly challenging in patients with serious facial bleeding.
- Blood supply to the face is rich.
  - Injuries can result in severe tissue swelling and bleeding into the airway.
  - Control bleeding with direct pressure, and suction as necessary.



## Review



1. Breathing is controlled by an area in the:
  - A. lungs.
  - B. brain stem.
  - C. spinal cord.
  - D. diaphragm.

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## Review

**Answer: B**

**Rationale:** The pons and the medulla are the respiratory centers in the brain stem that control breathing.

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## Review (1 of 2)

1. Breathing is controlled by an area in the:
  - A. lungs.  
**Rationale:** The lungs contain small pockets called alveoli where the exchange of oxygen and carbon dioxide takes place.
  - B. brain stem.  
**Rationale:** Correct answer

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## Review (2 of 2)

1. Breathing is controlled by an area in the:
  - C. spinal cord.  
**Rationale:** Impulses are sent down the spinal cord from the brain stem.
  - D. diaphragm.  
**Rationale:** The diaphragm receives the impulses that cause it to contract and bring air in.

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## Review



2. The EMT should assess a patient's tidal volume by:
- A. observing for adequate chest rise.
  - B. assessing the facial area for cyanosis.
  - C. counting the patient's respiratory rate.
  - D. measuring the patient's oxygen saturation.

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## Review

**Answer: A**

**Rationale:** Tidal volume—the volume of air that is moved into or out of the lungs in a single breath—is assessed by observing for adequate chest rise. If shallow chest rise is noted, the patient's tidal volume is likely reduced.

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## Review (1 of 2)

2. The EMT should assess a patient's tidal volume by:
- A. observing for adequate chest rise.  
**Rationale: Correct answer**
  - B. assessing the facial area for cyanosis.  
**Rationale: Cyanosis is an indication of hypoxia and not tidal volume.**

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## Review (2 of 2)

2. The EMT should assess a patient's tidal volume by:
- C. counting the patient's respiratory rate.  
**Rationale: Counting the respiratory rate gives you minute volume: the number of times a patient breaths in 1 minute.**
  - D. measuring the patient's oxygen saturation.  
**Rationale: Oxygen saturation is an indication of tissue perfusion, which is the amount of oxygen attached to the hemoglobin.**

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## Review



3. In an otherwise healthy individual, the primary stimulus to breathe is a(n):
- A. increased level of oxygen in the blood.
  - B. decreased level of oxygen in the blood.
  - C. increased level of carbon dioxide in the blood.
  - D. decreased level of carbon dioxide in the blood.

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## Review

**Answer: C**

**Rationale:** Under control of the brain stem, rising levels of carbon dioxide in arterial blood normally stimulate breathing in an otherwise healthy patient. In some patients with chronic lung disease, low levels of oxygen in the blood stimulate breathing; this is called the hypoxic drive.

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## Review (1 of 2)

3. In an otherwise healthy individual, the primary stimulus to breathe is a(n):
- A. increased level of oxygen in the blood.  
**Rationale:** Increased levels of oxygen can be a result of hyperventilation syndrome.
  - B. decreased level of oxygen in the blood.  
**Rationale:** This is typically not normal in healthy individuals. It can be a sign of inadequate breathing and results in hypoxia.

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## Review (2 of 2)

3. In an otherwise healthy individual, the primary stimulus to breathe is a(n):
- C. increased level of carbon dioxide in the blood.  
**Rationale:** Correct answer
  - D. decreased level of carbon dioxide in the blood.  
**Rationale:** This is usually not seen in healthy adults. It is typically a result of hyperventilation syndrome.

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## Review



4. Signs of adequate breathing in the adult include all of the following, EXCEPT:
- A. pink, warm, dry skin.
  - B. shallow chest rise.
  - C. symmetrical chest movement.
  - D. a respiratory rate of 16 breaths/min.

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## Review

**Answer: B**

**Rationale:** Signs of inadequate breathing in the adult include a respiratory rate less than 12 breaths/min or greater than 20 breaths/min, shallow chest rise (reduced tidal volume), cyanosis, and asymmetrical chest movement (both sides of the chest do not move equally).

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## Review (1 of 2)

4. Signs of adequate breathing in the adult include all of the following, EXCEPT:
- A. pink, warm, dry skin.  
**Rationale:** This shows that breathing and perfusion are adequate.
  - B. shallow chest rise.  
**Rationale:** Correct answer

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## Review (2 of 2)

4. Signs of adequate breathing in the adult include all of the following, EXCEPT:
- C. symmetrical chest movement.  
**Rationale:** This shows that the mechanical process of breathing is adequate, equal, and symmetrical bilaterally.
  - D. a respiratory rate of 16 breaths/min.  
**Rationale:** This is a normal respiratory rate for an adult.

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## Review



5. During insertion of an oropharyngeal airway into an unconscious patient, she begins to vomit. Immediately, the first thing you should do is:
- A. turn the patient on her side.
  - B. remove the airway at once.
  - C. suction the patient's mouth.
  - D. use a smaller sized oral airway.

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## Review

**Answer: A**

**Rationale:** Any time an unconscious patient begins to vomit—whether you are inserting an oropharyngeal airway or not—you should *immediately* turn the patient onto his or her side; this will allow drainage of vomit from the mouth and prevent aspiration. After the patient is on his or her side, remove the oral airway and suction the mouth.

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## Review (1 of 2)

5. During insertion of an oropharyngeal airway into an unconscious patient, she begins to vomit. Immediately, the first thing you should do is:
- A. turn the patient on her side.  
**Rationale: Correct answer**
  - B. remove the airway at once.  
**Rationale: Remove the airway after the patient has been rolled onto her side.**

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## Review (2 of 2)

5. During insertion of an oropharyngeal airway into an unconscious patient, she begins to vomit. Immediately, the first thing you should do is:
- C. suction the patient's mouth.  
**Rationale: This must be completed after the patient is positioned and the airway is removed.**
  - D. use a smaller sized oral airway.  
**Rationale: Oropharyngeal airways are contraindicated if the patient has a gag reflex.**

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## Review



6. In which of the following patients would a nasopharyngeal airway be contraindicated?
- A. A semiconscious patient with a gag reflex
  - B. An unconscious patient with an intact gag reflex
  - C. A patient who fell 20 feet and landed on his or her head
  - D. An unconscious patient who gags when you insert an oral airway

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## Review

**Answer: C**

**Rationale:** Nasopharyngeal (nasal) airways are contraindicated in patients with severe head or facial injuries and should be used with caution in patients who have delicate nasal membranes or are prone to nosebleeds. The nasal airway is better tolerated in patients who are semiconscious and/or those with a gag reflex.

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## Review (1 of 2)

6. In which of the following patients would a nasopharyngeal airway be contraindicated?
- A. A semiconscious patient with a gag reflex  
**Rationale:** This airway works best with an intact gag reflex.
  - B. An unconscious patient with an intact gag reflex  
**Rationale:** This airway works best with an intact gag reflex.

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## Review (2 of 2)

6. In which of the following patients would a nasopharyngeal airway be contraindicated?
- C. A patient who fell 20 feet and landed on his or her head  
**Rationale:** Correct answer
  - D. An unconscious patient who gags when you insert an oral airway  
**Rationale:** This airway can be used when the patient gags with an oral airway.

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## Review



7. You are delivering oxygen to a patient with a nasal cannula at 4 L/min when he begins to complain of a burning sensation in his nose. You should:
- A. remove the nasal cannula.
  - B. apply a nonrebreathing mask.
  - C. attach an oxygen humidifier.
  - D. increase the flow rate to 6 L/min.

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## Review

**Answer: C**

**Rationale:** Administering “dry” oxygen through a nasal cannula—especially over a prolonged period of time—can result in drying of the nasal membranes, in which case the patient might complain of a burning sensation in the nose. Humidified oxygen will serve to keep the nasal membranes moist.

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## Review (1 of 2)

7. You are delivering oxygen to a patient with a nasal cannula at 4 L/min when he begins to complain of a burning sensation in his nose. You should:
- A. remove the nasal cannula.  
**Rationale:** The oxygen should be humidified.
  - B. apply a nonrebreathing mask.  
**Rationale:** This can still cause an irritation due to providing “dry” oxygen.

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## Review (2 of 2)

7. You are delivering oxygen to a patient with a nasal cannula at 4 L/min when he begins to complain of a burning sensation in his nose. You should:
- C. attach an oxygen humidifier.  
**Rationale:** Correct answer
  - D. increase the flow rate to 6 L/min.  
**Rationale:** The oxygen should be humidified.

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## Review



8. A patient is found unconscious after falling from a third floor window. His respirations are slow and irregular. You should:
- A. place him in the recovery position.
  - B. apply oxygen via a nonrebreathing mask.
  - C. suction his airway for up to 15 seconds.
  - D. assist his breathing with a bag-mask device.

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## Review

**Answer: D**

**Rationale:** The patient is not breathing adequately. Slow, irregular respirations will not result in adequate oxygenation. You should assist the patient's breathing with a bag-mask device attached to 100% oxygen. Suctioning is indicated if the patient has blood or other liquids in the airway; there is no evidence of this in the scenario.

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## Review (1 of 2)

8. A patient is found unconscious after falling from a third floor window. His respirations are slow and irregular. You should:
- A. place him in the recovery position.  
**Rationale:** Due to a significant MOI, the patient will be placed supine on a long backboard with the head immobilized.
  - B. apply oxygen via a nonrebreathing mask.  
**Rationale:** A BVM device is indicated if the patient's respirations are less than 12 breaths/min.

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## Review (2 of 2)

8. A patient is found unconscious after falling from a third floor window. His respirations are slow and irregular. You should:
- C. suction his airway for up to 15 seconds.  
**Rationale:** Suction is indicated if a patient has blood or other secretions in the airway.
  - D. assist his breathing with a bag-mask device.  
**Rationale:** Correct answer

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## Review



9. When ventilating an apneic adult with a bag-mask device, you should squeeze the bag:
- A. until it is empty.
  - B. over a period of 2 seconds.
  - C. at a rate of 20 breaths/min.
  - D. until visible chest rise is noted.

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## Review

**Answer: D**

**Rationale:** When ventilating any apneic patient with a bag-mask device, you should squeeze the bag over a period of 1 second and observe for visible chest rise. Ventilate the apneic adult at a rate of 10 to 12 breaths/min (one breath every 5 to 6 seconds). Ventilate infants and children at a rate of 12 to 20 breaths/min (one breath every 3 to 5 seconds).

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## Review (1 of 2)

9. When ventilating an apneic adult with a bag-mask device, you should squeeze the bag:
- A. until it is empty.  
**Rationale:** An appropriately sized bag for an adult will not totally empty.
  - B. over a period of 2 seconds.  
**Rationale:** You should squeeze the bag over a period of 1 second.

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## Review (2 of 2)

9. When ventilating an apneic adult with a bag-mask device, you should squeeze the bag:
- C. at a rate of 20 breaths/min.  
**Rationale:** Ventilate the apneic adult at a rate of 10 to 12 breaths/min (or one breath every 5 to 6 seconds).
  - D. until visible chest rise is noted.  
**Rationale:** Correct answer

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## Review



10. You and your partner are ventilating an apneic adult when you notice that his stomach is becoming distended. You should:
- A. suction his airway for up to 15 seconds.
  - B. reposition his head and use cricoid pressure.
  - C. increase the rate and volume of your ventilations.
  - D. decrease your ventilation rate but use more volume.

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## Review

- Answer: B**
- Rationale:** Gastric distension occurs when air enters the stomach. Severe gastric distention can result in vomiting and aspiration if not recognized and treated. To minimize the amount of air that enters the stomach during ventilations, you should reposition the patient's head and use cricoid pressure (Sellick maneuver).

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## Review (1 of 2)

10. You and your partner are ventilating an apneic adult when you notice that his stomach is becoming distended. You should:
- A. suction his airway for up to 15 seconds.  
**Rationale:** Suctioning is indicated when there is blood or secretions in the airway.
  - B. reposition his head and use cricoid pressure.  
**Rationale:** Correct answer

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## Review (2 of 2)

10. You and your partner are ventilating an apneic adult when you notice that his stomach is becoming distended. You should:
- C. increase the rate and volume of your ventilations.  
**Rationale:** This action may only result in more air going into the stomach.
  - D. decrease your ventilation rate but use more volume.  
**Rationale:** This action may only result in more air going into the stomach.

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