Virginia EMS Symposium

November 11, 2011

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BLS Airway Management

Objectives

- Highlight the changes from the 1994 EMT-Basic Curriculum
- Review the Virginia Scope of Practice – Airway Techniques for the EMT
- Discuss the new EMS education standards related to Airway Management

The Phoenix Document

- **An Evolution from National Standard**
- **Curriculum to the Virginia EMS Education**
- **Standards**
- Training Levels Included:
- □□ Emergency Medical Responder (EMR)
- □□ Emergency Medical Technician (EMT)

New skills for the EMT-Basic
(1 of 3)

- o Use of oxygen humidifiers
- o Use of partial rebreather masks
- o Use of simple face masks
- o Use of Venturi masks

New Skills for EMT (2 of 3)

- o Obtaining a pulse oximetry value
- o Determining blood glucose
- o Use of automated transport ventilators
- o Use of mechanical CPR devices

New Skills for EMT (3 of 3)

- o Application of mechanical patient restraint
- o Assisting a patient with his/her prescribed medications, nebulized/aerosolized
- o Administration of aspirin by mouth
- o Use of an auto-injector

Virginia Office of Emergency Medical Services
Scope of Practice - Procedures for EMS Personnel

This SOP represents ***practice maximums*** .

PROCEDURE	SKILL	PROCEDURE SUBTYPE	OEMS use	EMR	EMT	AEMT	I	P
Specific tasks in this document shall refer to the Virginia Education Standards.								
AIRWAY TECHNIQUES								
Airway Adjuncts								
	Oropharyngeal Airway			●	●	●	●	●
	Nasopharyngeal Airway			●	●	●	●	●
Airway Maneuvers								
	Head tilt jaw thrust			●	●	●	●	●
	Jaw thrust			●	●	●	●	●
	Chin lift			●	●	●	●	●
	Cricoid Pressure			●	●	●	●	●
	Management of existing Tracheostomy				●	●	●	●
Alternate Airway Devices								
	Non Visualized Airway Devices	Supraglottic			●	●	●	●
Cricothyrotomy								
	Needle							●
	Surgical							●
Obstructed Airway Clearance								
	Manual			●	●	●	●	●
	Visualize Upper-airway		direct laryngoscopy			●	●	●
Intubation								
	Nasotracheal							●
	Orotracheal - Over age 12						●	●
	Pharmacological facilitation with paralytic	Adult Neuromuscular Blockade						●
	Pharmacological facilitation without paralytic							●
	Confirmation procedures				●	●	●	●
	Pediatric Orotracheal							●
	Pediatric paralytics							●
	Pediatric sedation							●
**** Endotracheal intubation is prohibited for all levels except Intermediate and Paramedic**								

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Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

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PROCEDURE	SKILL	PROCEDURE SUBTYPE	OEMS use	EMR	EMT	AEMT	I	P
Oxygen Delivery Systems								
	Nasal Cannula			●	●	●	●	●
	Venturi Mask				●	●	●	●
	Simple Face Mask			●	●	●	●	●
	Partial Rebreather Face Mask				●	●	●	●
	Non-rebreather Face Mask			●	●	●	●	●
	Face Tent				●	●	●	●
	Tracheal Cuff				●	●	●	●
	Oxygen Hood						●	●
	O2 Powered Flow restricted device				●	●	●	●
	Humidification				●	●	●	●
Suction								
	Manually Operated			●	●	●	●	●
	Mechanically Operated			●	●	●	●	●
	Pharyngeal			●	●	●	●	●
	Bronchial-Tracheal				●	●	●	●
	Oral Suctioning			●	●	●	●	●
	Naso-pharyngeal Suctioning				●	●	●	●
	Endotracheal Suctioning				●	●	●	●
	Meconium Aspiration Neonate with ET							●
Ventilation – assisted / mechanical								
	Mouth to Mask		Includes :mouth t	●	●	●	●	●
	Mouth to Mask with O2			●	●	●	●	●
	Bag-Valve-Mask Adult			●	●	●	●	●
	Bag-Valve-Mask with supplemental O2 Adult			●	●	●	●	●
	Bag-Valve-Mask with supplemental O2 and reservoir Adult			●	●	●	●	●
	Bag-Valve-Mask Pediatric			●	●	●	●	●

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Scope of Practice - Procedures for EMS Personnel

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PROCEDURE	SKILL	PROCEDURE SUBTYPE	OEMS use	EMR	EMT	AEMT	I	P
	Bag-Valve-Mask with supplemental O2 Pediatric			●	●	●	●	●
	Bag-Valve-Mask with supplemental O2 and reservoir Pediatric			●	●	●	●	●
	Bag-Valve-Mask neonate/infant			●	●	●	●	●
	Bag-Valve-Mask with supplemental O2 Neonate/Infant			●	●	●	●	●
	Bag-Valve-Mask with supplemental O2 and reservoir Neonate/Infant			●	●	●	●	●
	Noninvasive positive pressure vent.		BiPAP;CPAP;PEEP		●	●	●	●
	Jet insuflation							●
	Mechanical Ventilator (Manual/Automated Transport Ventilator)					●	●	●
Anesthesia (Local)							●	●
Pain Control & Sedation								
	Self Administered inhaled analgesics				●	●	●	●
	Pharmacological (non-inhaled)					●	●	●
Blood and Component Therapy Administration							●	●
Diagnostic Procedures								
	Blood chemistry analysis				●	●	●	●
	Capnography				●	●	●	●
	Pulmonary function measurement					●	●	●
	Pulse Oximetry				●	●	●	●
	Ultrasonography							●
Genital/Urinary								
	Bladder catheterization							
	Foley catheter							●

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National EMS Education Standard Competencies (1 of 6)

Airway Management, Respiration, and Artificial Ventilation

Applies knowledge of general anatomy and physiology to patient assessment and management in order to assure a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

National EMS Education Standard Competencies (2 of 6)

Airway Management

- Airway anatomy
- Airway assessment
- Techniques of assuring a patent airway

National EMS Education Standard Competencies (3 of 6)

Respiration

- Anatomy of the respiratory system
- Physiology and pathophysiology of respiration
  - Pulmonary ventilation
  - Oxygenation
  - Respiration (external, internal, cellular)

National EMS Education Standard Competencies (4 of 6)

Respiration (cont'd)

- Assessment and management of adequate and inadequate respiration
- Supplemental oxygen therapy

Artificial Ventilation

- Assessment and management of adequate and inadequate ventilation
- Artificial ventilation

National EMS Education Standard Competencies (5 of 6)

Artificial Ventilation (cont'd)

- Minute ventilation
- Alveolar ventilation
- Effect of artificial ventilation on cardiac output

National EMS Education Standard Competencies (6 of 6)

Pathophysiology

Applies fundamental knowledge of the pathophysiology of respiration and perfusion to patient assessment and management.

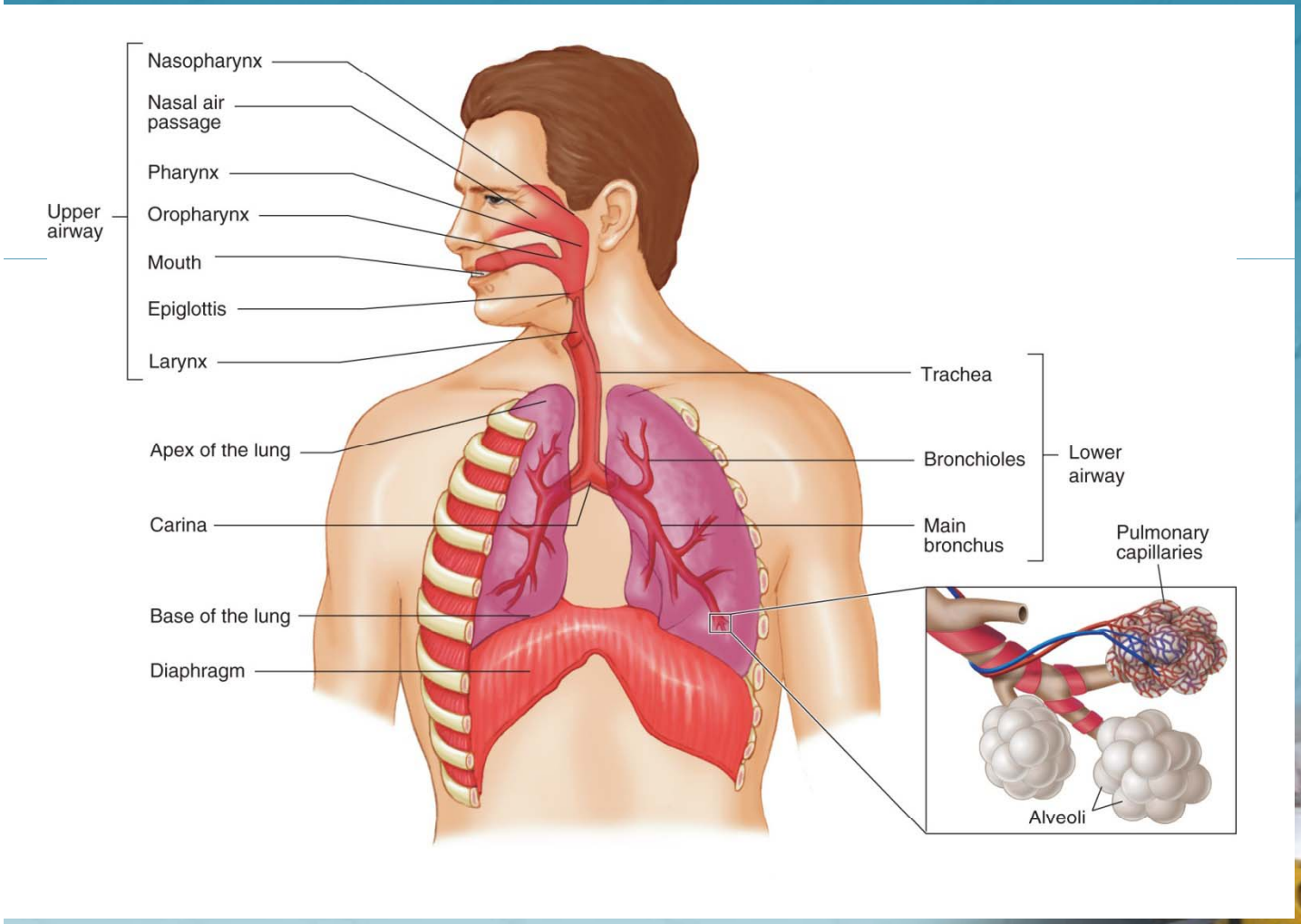
Introduction (1 of 2)

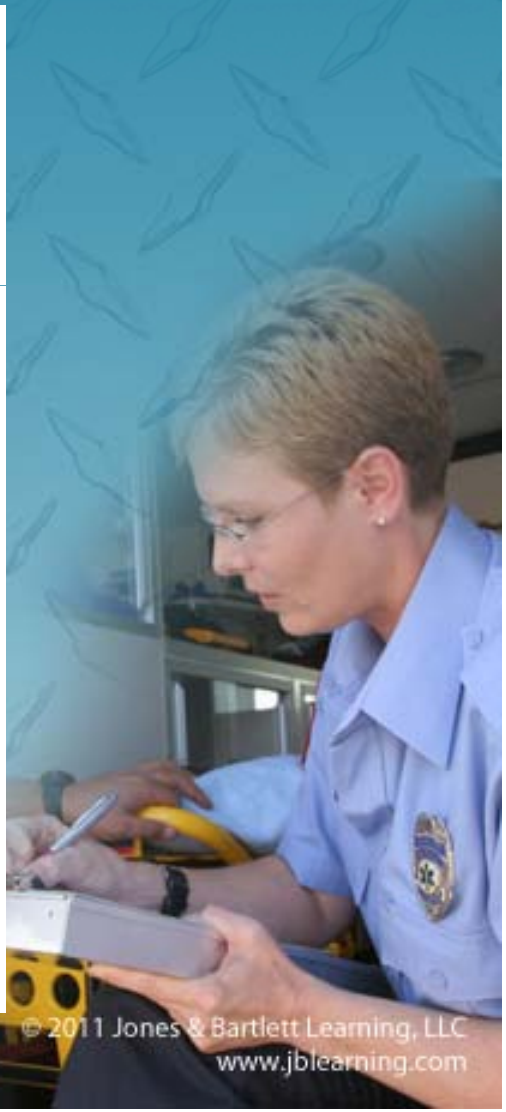
- When the ability to breathe is disrupted:
  - Oxygen delivery to tissues and cells is compromised.
  - Vital organs may not function normally.
  - Brain tissue will begin to die within 4 to 6 minutes.

Introduction (2 of 2)

- A patent airway is essential for adequate Breathing
- Oxygen reaches body tissues and cells through breathing and circulation.
- You must be able to locate the parts of the respiratory system and understand how the system works.

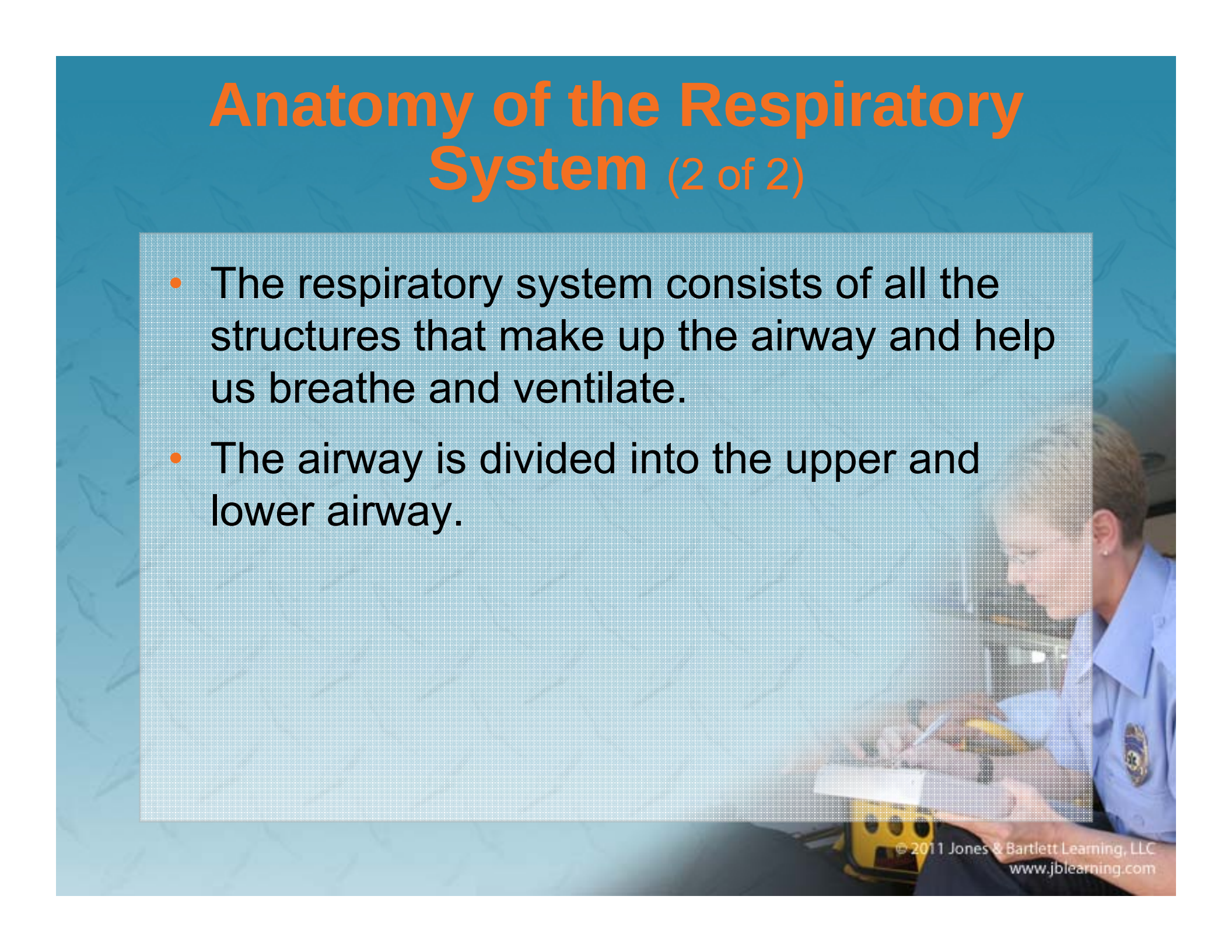
Anatomy of the Respiratory System (1 of 2)





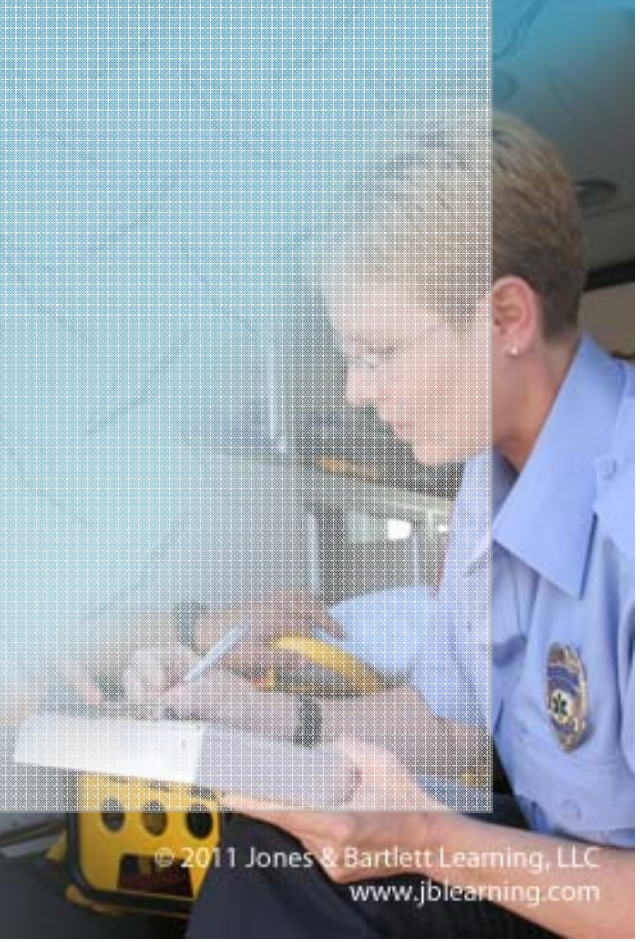
Anatomy of the Respiratory System (2 of 2)

- The respiratory system consists of all the structures that make up the airway and help us breathe and ventilate.
- The airway is divided into the upper and lower airway.



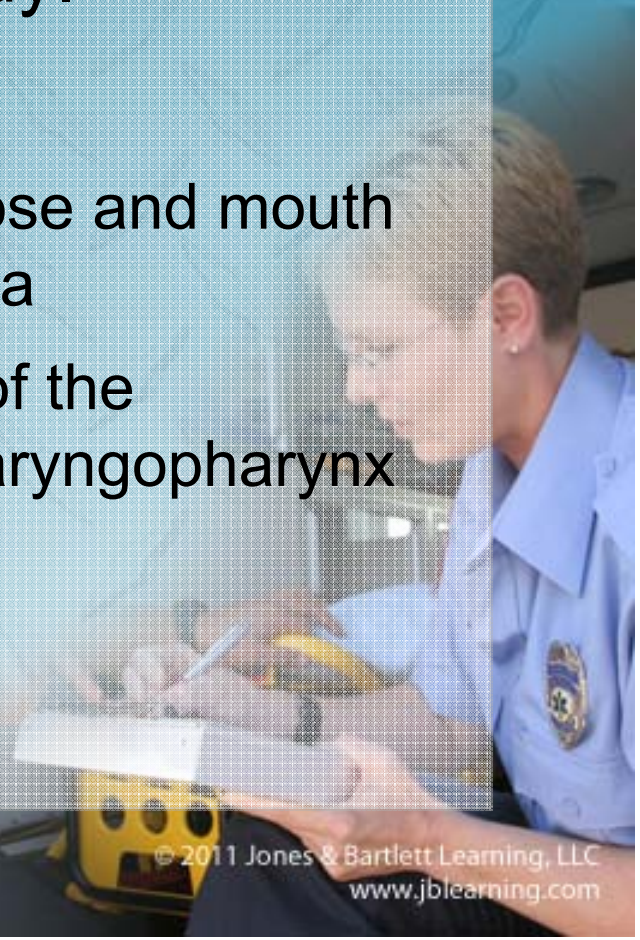
Anatomy of the Upper Airway
(1 of 7)

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

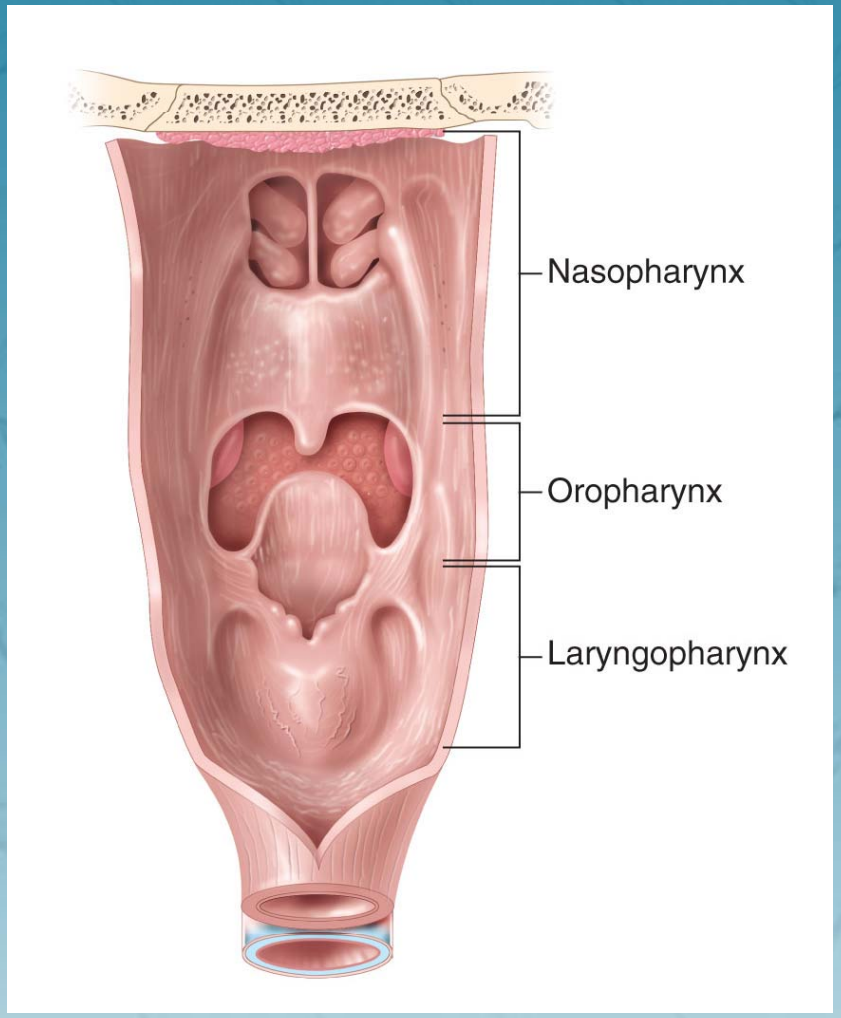


Anatomy of the Upper Airway
(2 of 7)

- 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



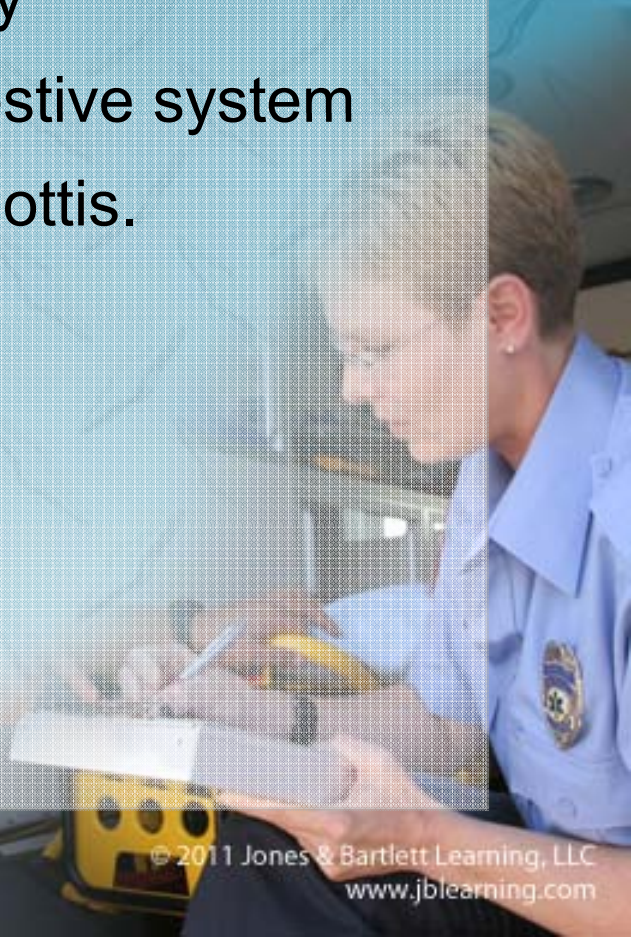
Anatomy of the Upper Airway
(3 of 7)



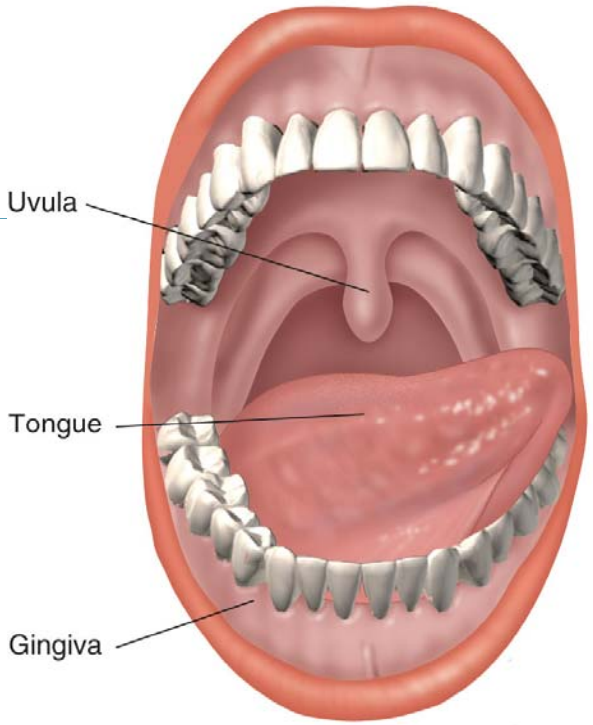
- Nasopharynx
  - Formed by the union of facial bones
  - Warms and humidifies air as it enters the body

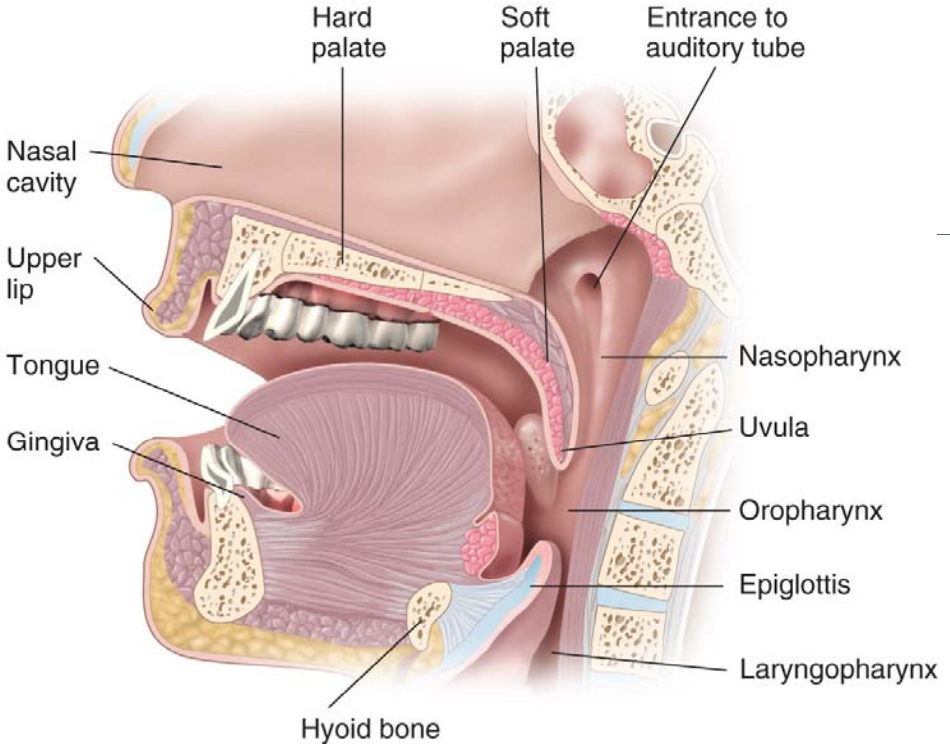
Anatomy of the Upper Airway
(4 of 7)

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

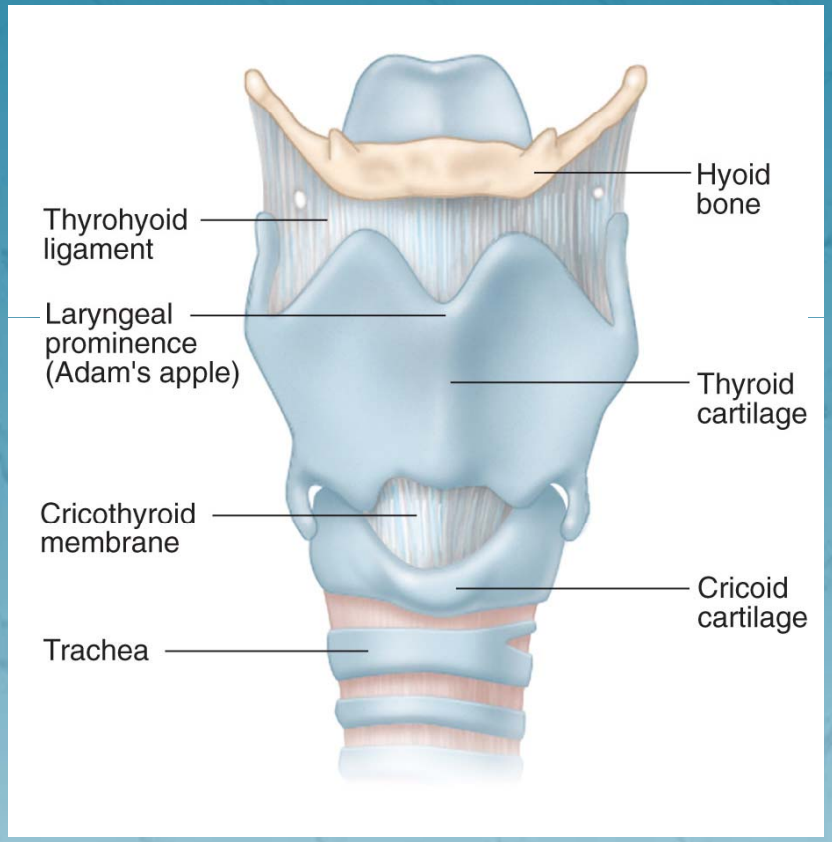


Anatomy of the Upper Airway
(5 of 7)





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.

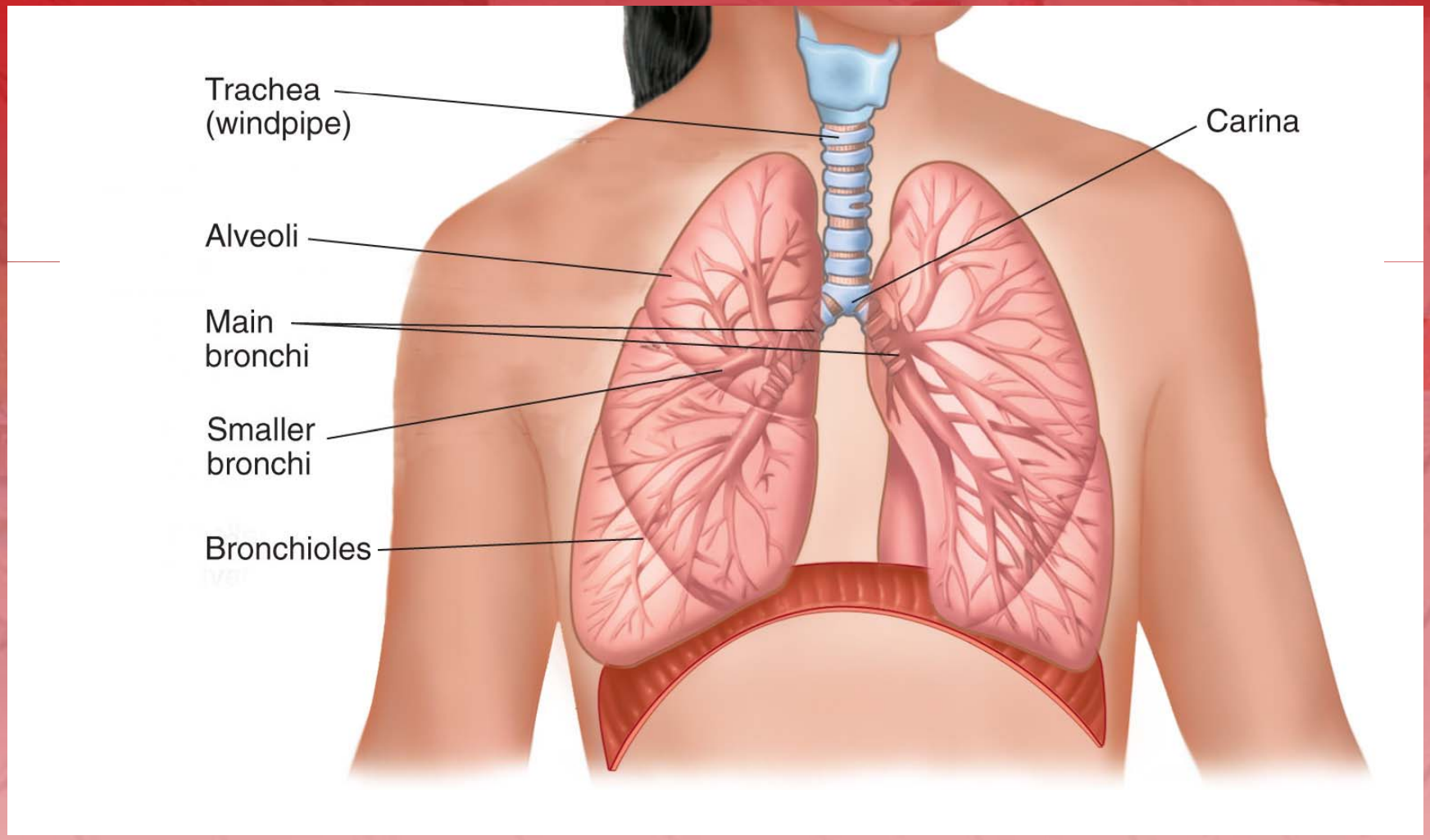
Anatomy of the Lower Airway
(1 of 6)

- 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.

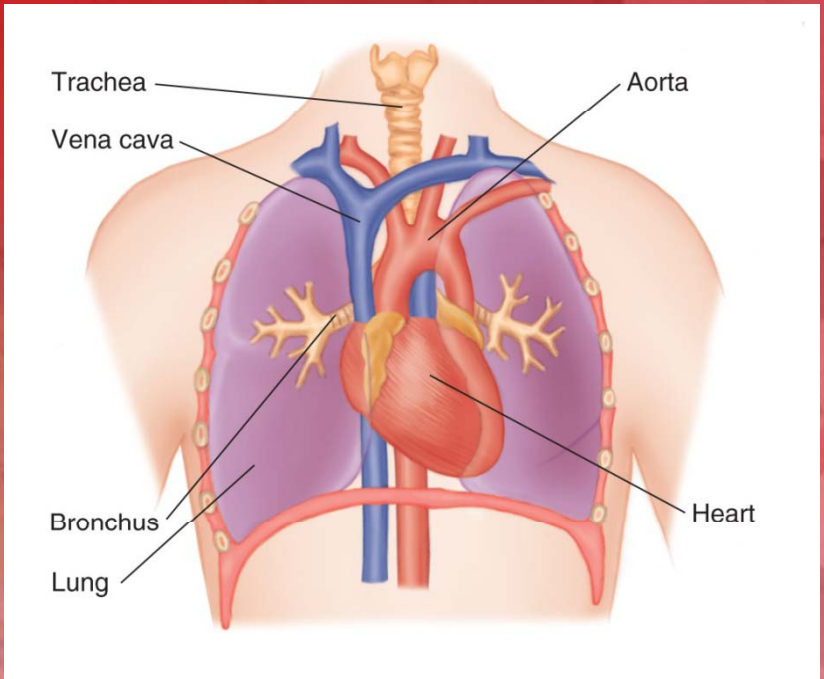
Anatomy of the Lower Airway
(3 of 6)



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.

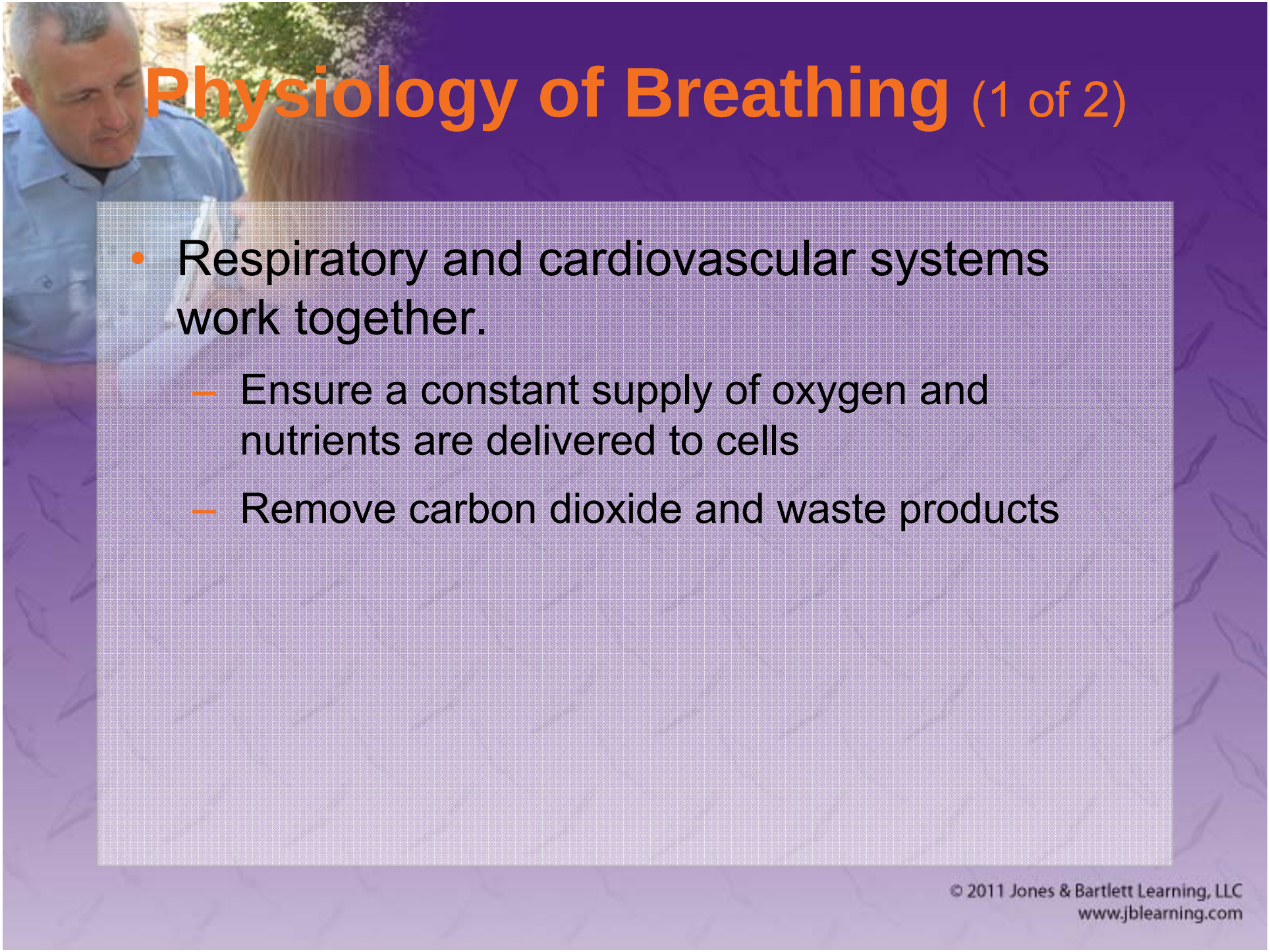
Anatomy of the Lower Airway
(5 of 6)



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

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



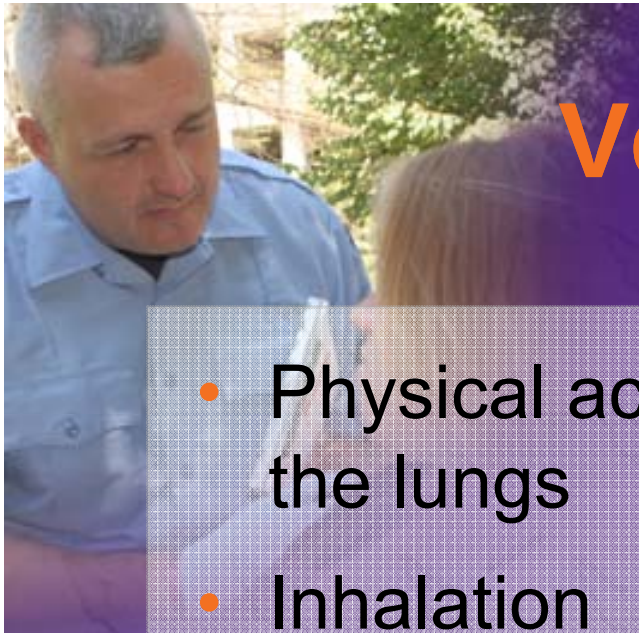
Physiology of Breathing (1 of 2)

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

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



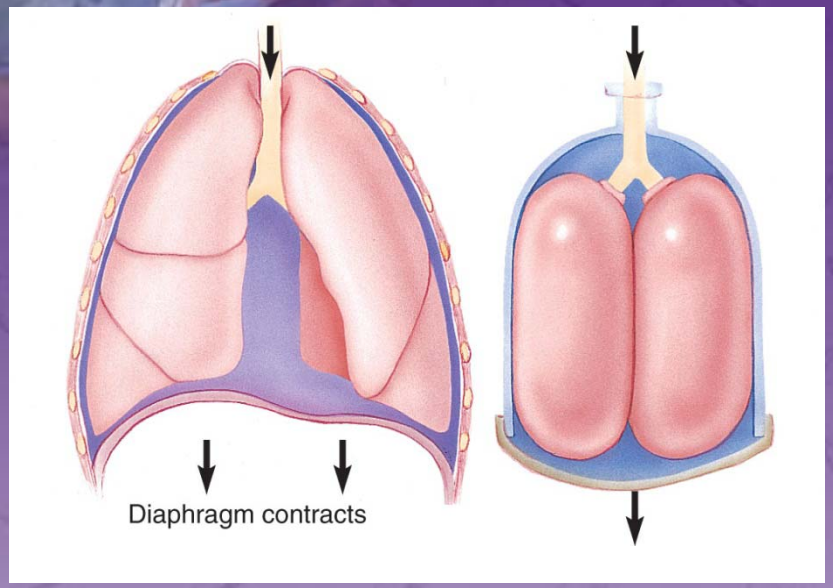
Ventilation (1 of 7)

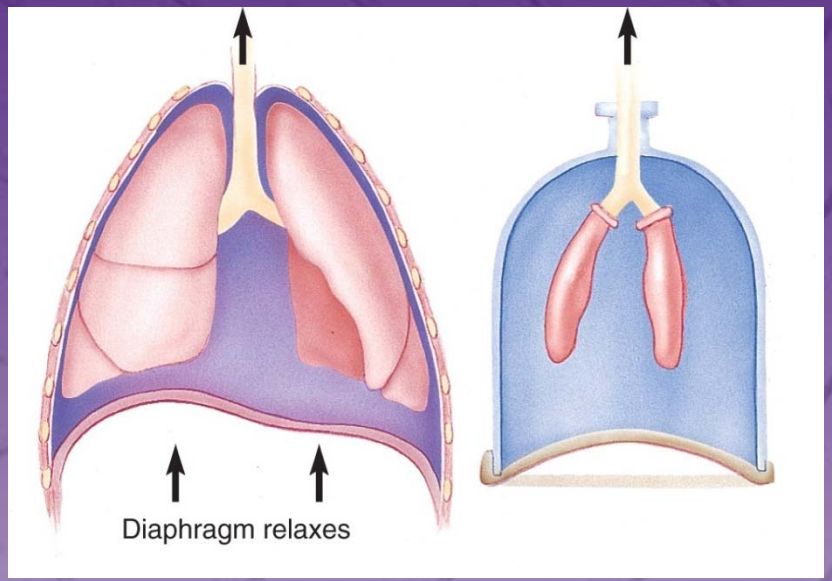
- Physical act of moving air into and out of the lungs
- Inhalation
  - Active, muscular part of breathing
  - Diaphragm and intercostal muscles contract.
  - Diaphragm acts as a voluntary and involuntary muscle.

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.

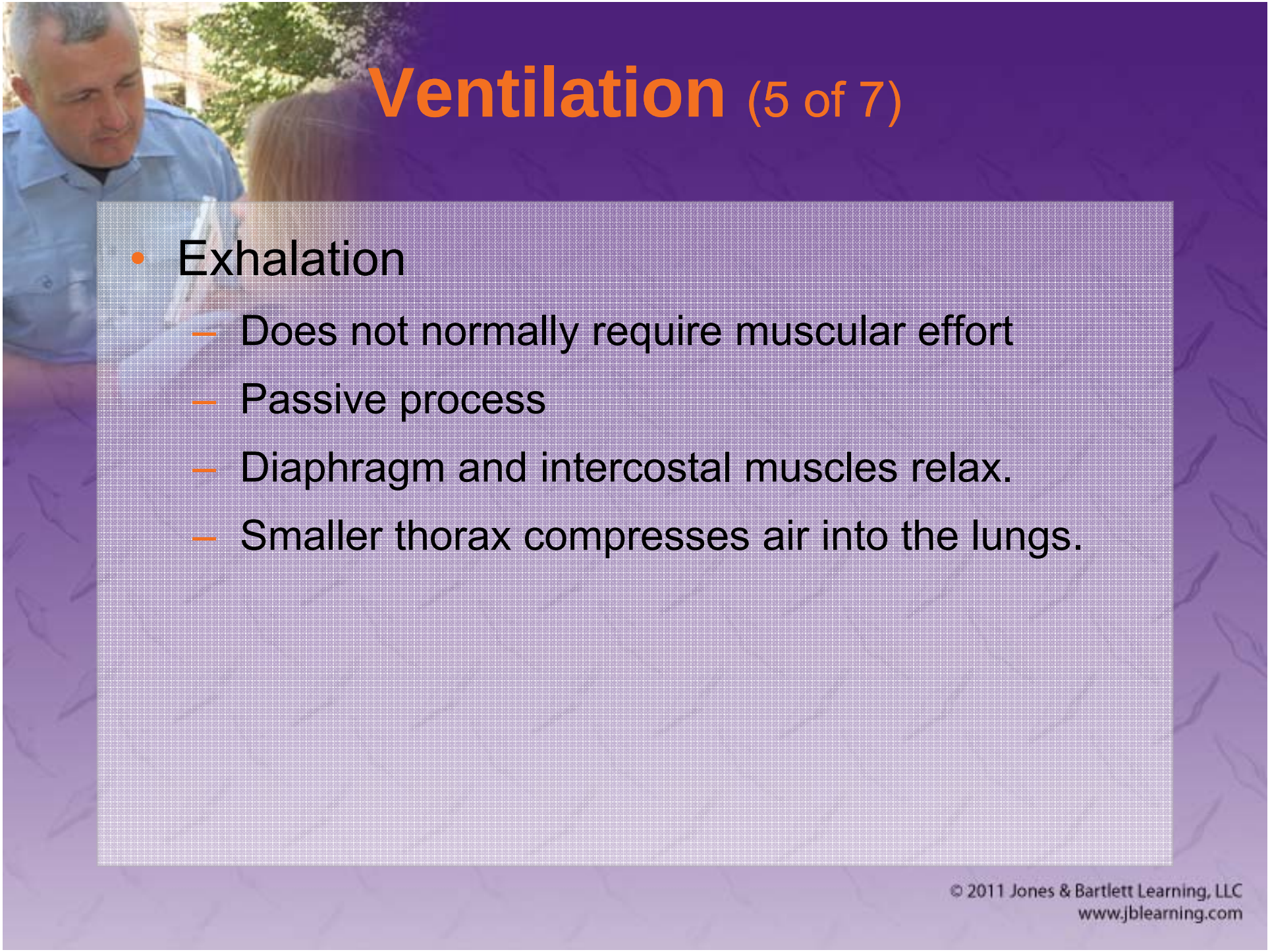
Ventilation (3 of 7)





Ventilation (4 of 7)

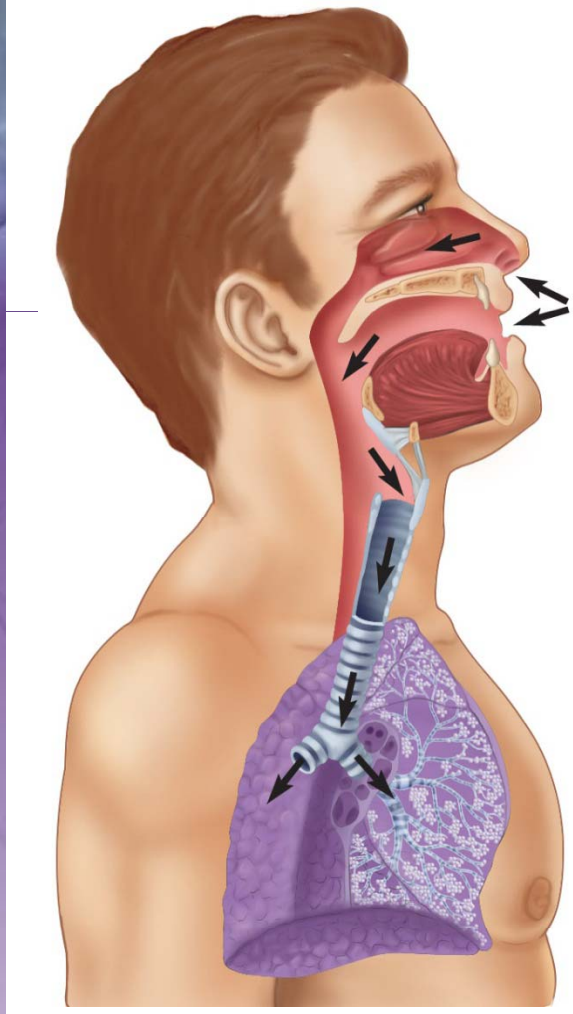
- Inhalation (cont'd)
  - Inspiration focuses on delivering oxygen to alveoli.
  - Tidal volume
  - Dead space
  - Minute ventilation
  - Vital capacity
  - Residual volume



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.

Ventilation (6 of 7)



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

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.

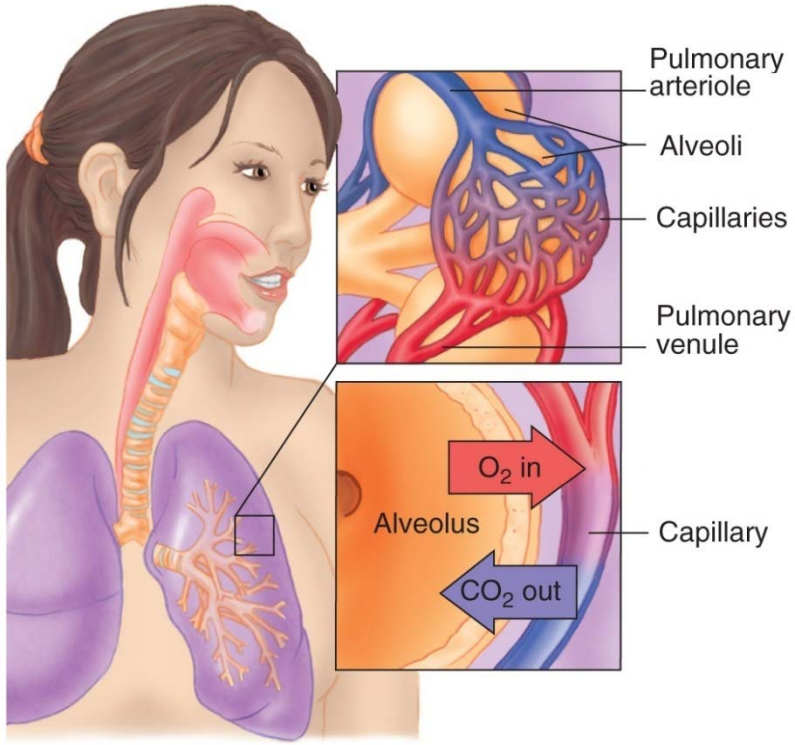
Oxygenation

- 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

Respiration (1 of 4)

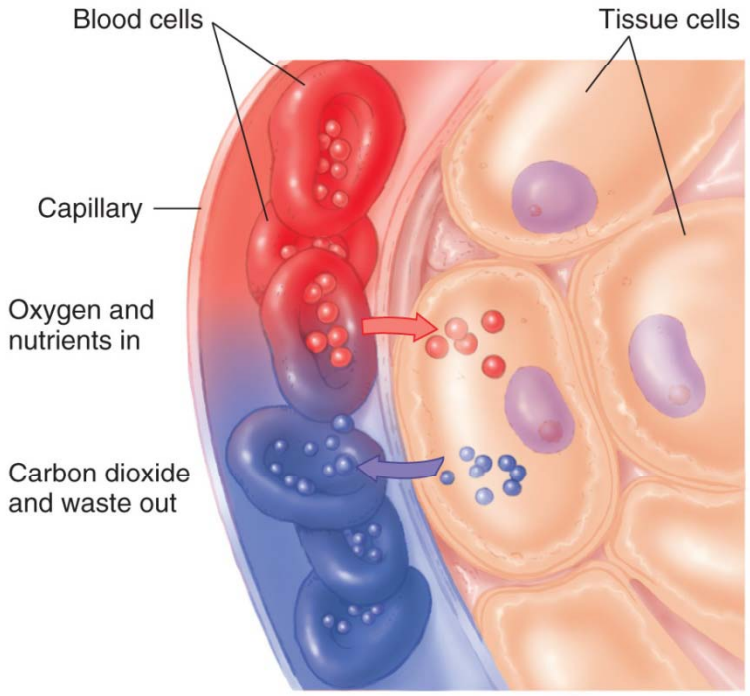
- Actual exchange of oxygen and carbon dioxide in the alveoli and tissues of the body
- Cells take energy from nutrients through metabolism.

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

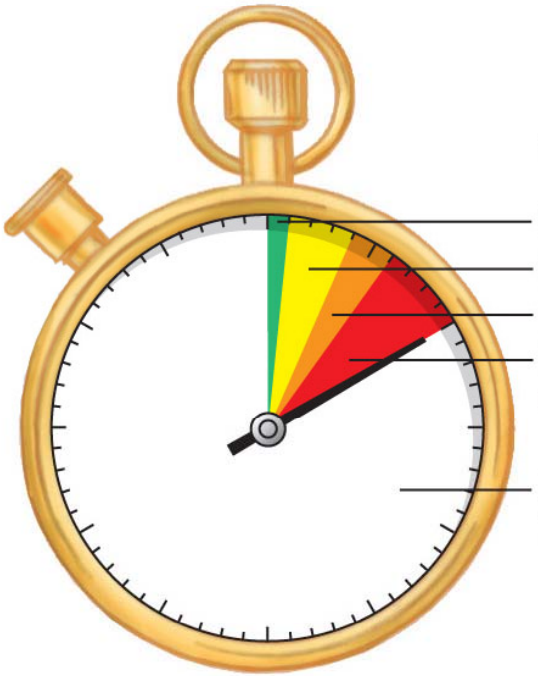
Respiration (3 of 4)



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

Respiration (4 of 4)

- Eventually all cells will die if deprived of oxygen.



TIME IS CRITICAL!

0–1 min: cardiac irritability
0–4 min: brain damage not likely
4–6 min: brain damage possible
6–10 min: brain damage very likely

More than 10 minutes: irreversible brain damage

Pathophysiology of Respiration (1 of 7)

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

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.

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.

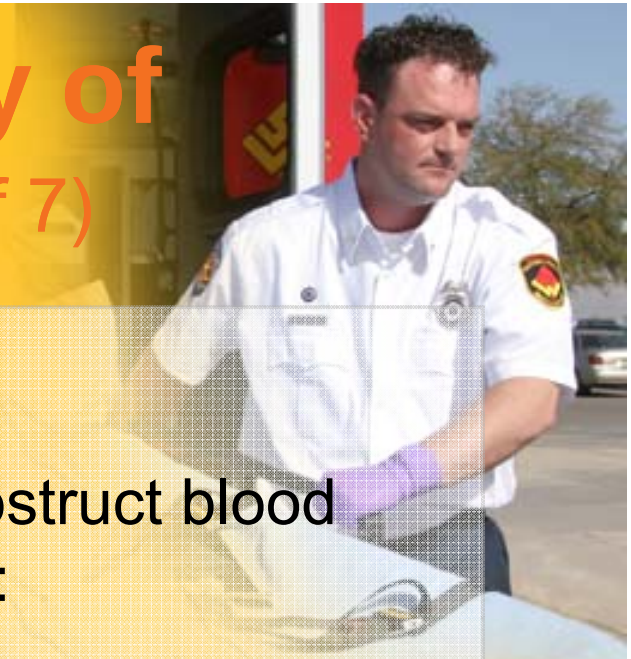
Pathophysiology of Respiration (4 of 7)

- 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

Pathophysiology of Respiration (5 of 7)

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

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

Pathophysiology of Respiration (7 of 7)

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

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)

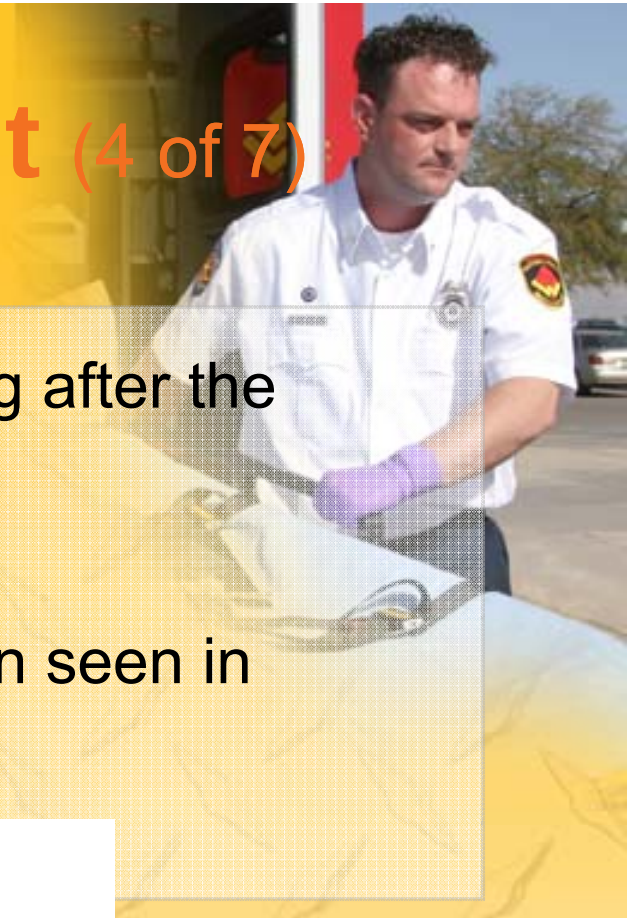
Patient Assessment (2 of 7)

- 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

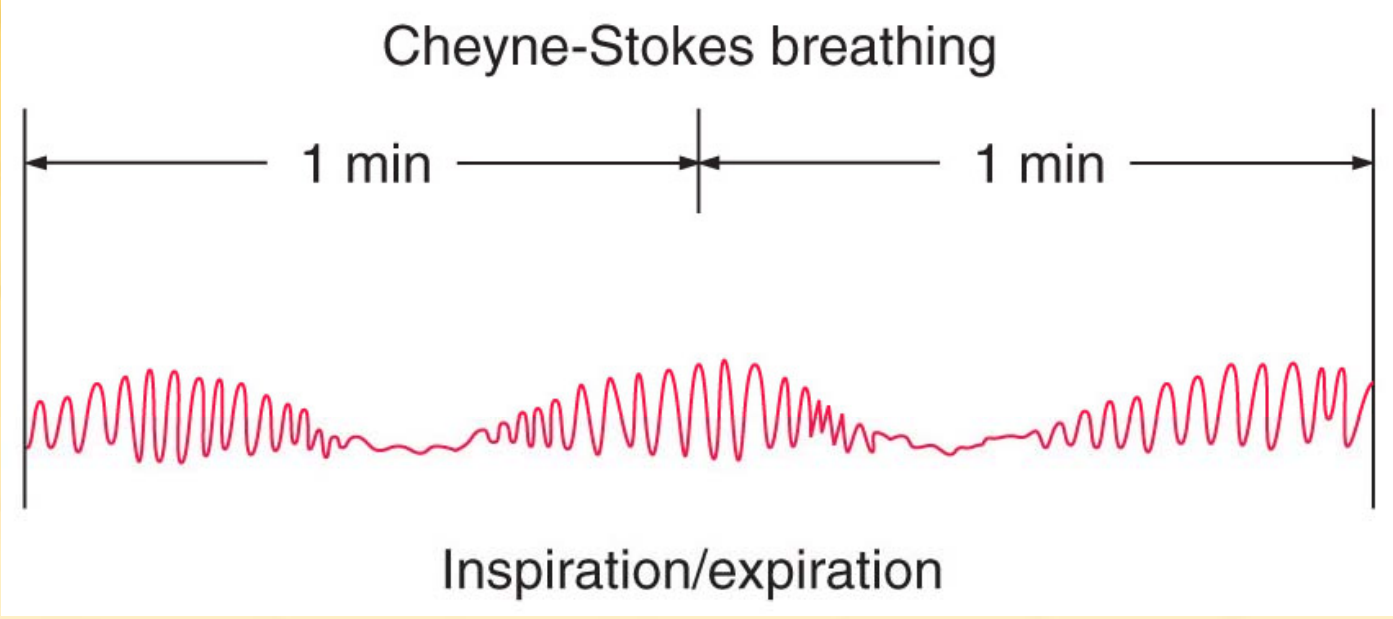
Patient Assessment (3 of 7)

- 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

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.



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.

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.

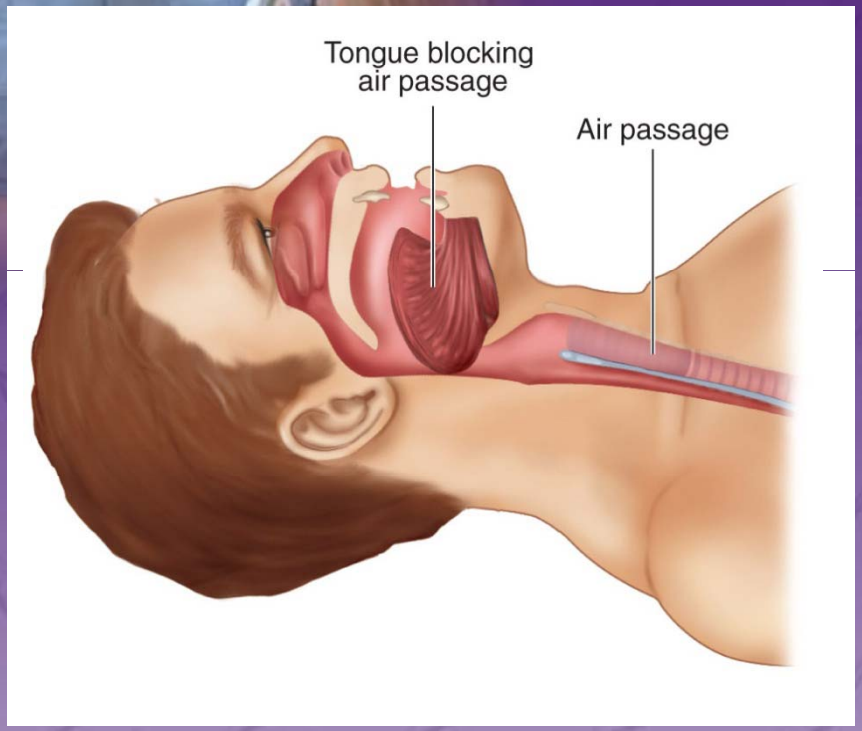
Patient Assessment (7 of 7)

- 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

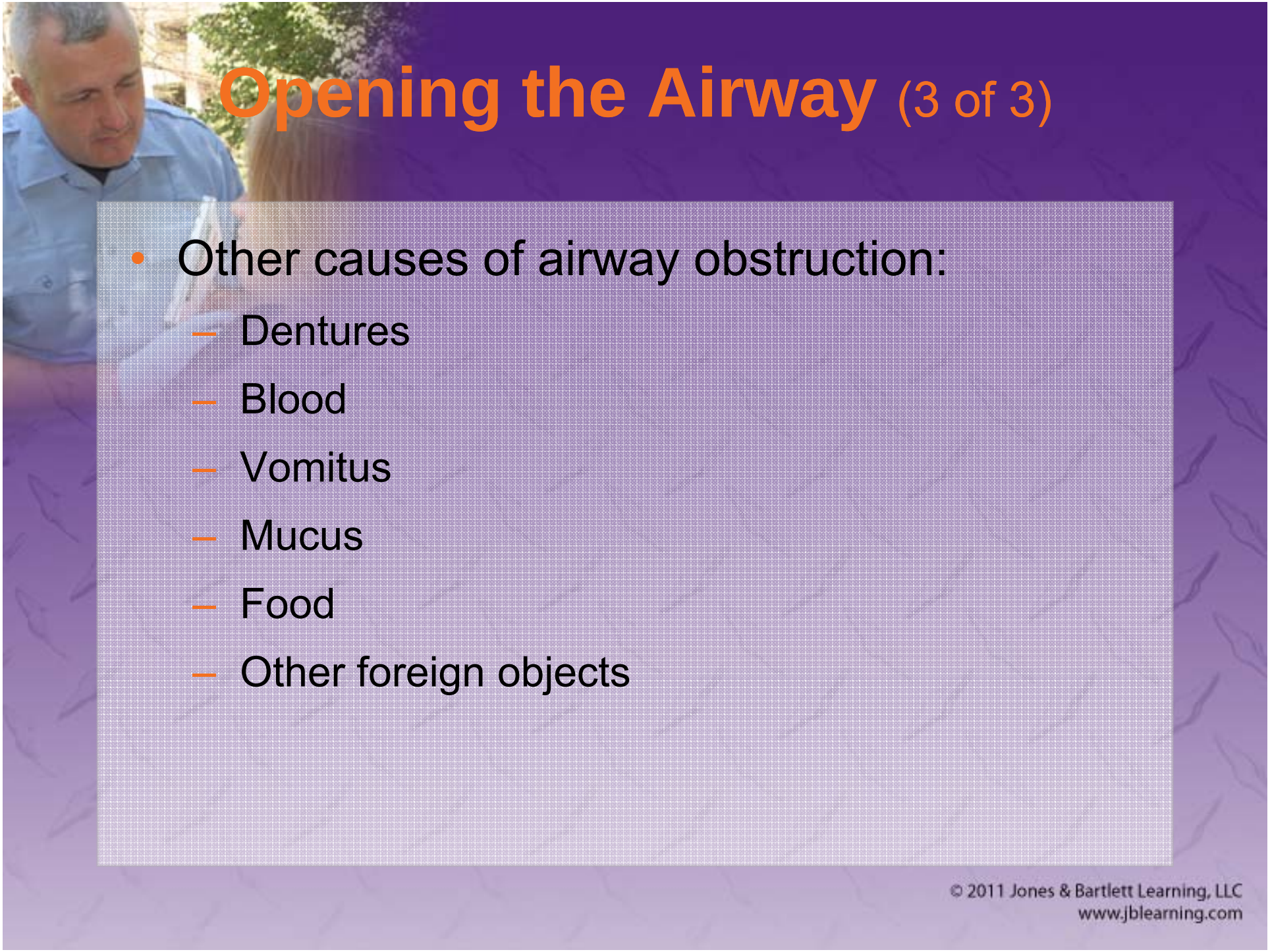
Opening the Airway (1 of 3)

- 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.

Opening the Airway (2 of 3)



- Unconscious patients should be moved as a unit.
  - Most common airway obstruction is the tongue.



Opening the Airway (3 of 3)

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

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

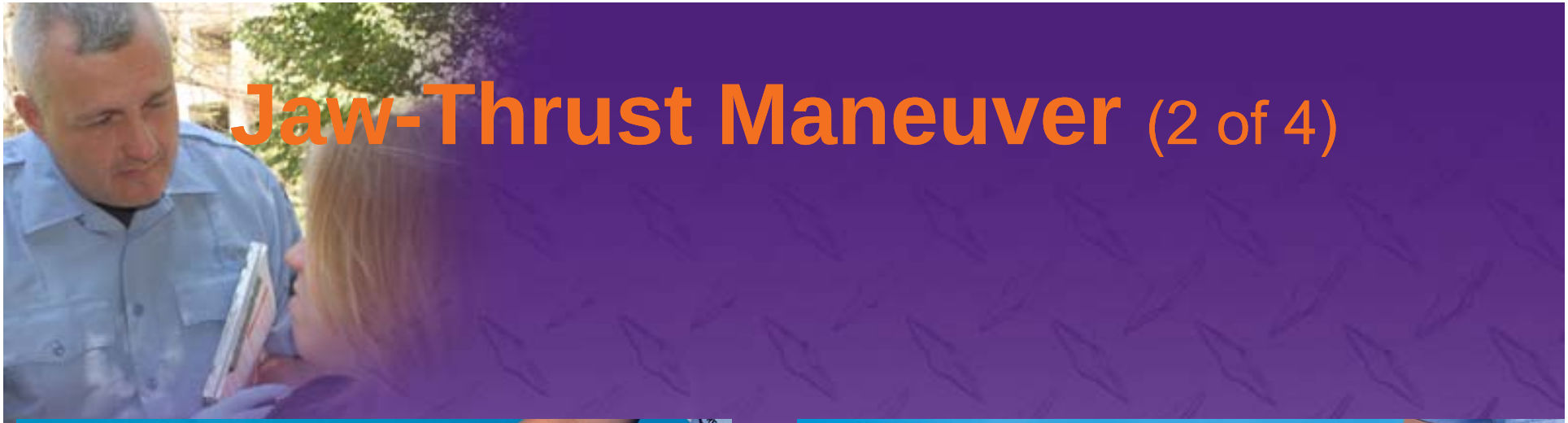
Head Tilt–Chin Lift Maneuver
(2 of 3)

- Follow these steps:
  - With patient supine, position yourself beside patient's head.
  - Place heel of one hand on forehead, apply firm backward pressure with palm.
  - Place fingertips of other hand under lower jaw.
  - Lift chin upward, with entire lower jaw.

Jaw-Thrust Maneuver (1 of 4)

- If you suspect a cervical spine injury, use this maneuver.
- Follow these steps:
  - Kneel above the patient's head.
  - Place your fingers behind the angles of the lower jaw.
  - Move the jaw upward.
  - Use your thumbs to help position the jaw.

Jaw-Thrust Maneuver (2 of 4)



Jaw-Thrust Maneuver (3 of 4)

- Use the look, listen, and feel technique to assess whether breathing has returned.
- With complete airway obstruction, there will be no movement of air.
  - Chest wall movement alone does not indicate that adequate breathing is present.

Basic Airway Adjuncts (1 of 6)

- Prevents obstruction by the tongue and allows for passage of air and oxygen to the lungs

- Oropharyngeal airways
  - Keep tongue from blocking upper airway.
  - Make it easier to suction oropharynx if necessary.

Basic Airway Adjuncts (2 of 6)

- Oropharyngeal airways (cont'd)
  - Indications include:
    - Unresponsive patients with a gag reflex
    - Apneic patients being ventilated with a bag-mask device
  - Contraindications include:
    - Conscious patients
    - Any patient who has an intact gag reflex

Basic Airway Adjuncts (3 of 6)

Nasopharyngeal airways

A nasal airway is better tolerated than is an oral airway by patients who have an intact gag reflex.

Figure 09.22

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Basic Airway Adjuncts (4 of 6)

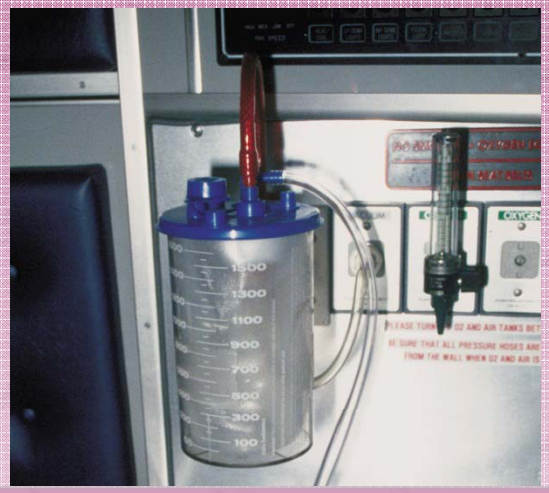
- Nasopharyngeal airways
  - Used with a patient who:
    - Is unresponsive or has an altered LOC
    - Has intact gag reflex
    - Is unable to maintain his or her own airway spontaneously

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

Suctioning (1 of 2)

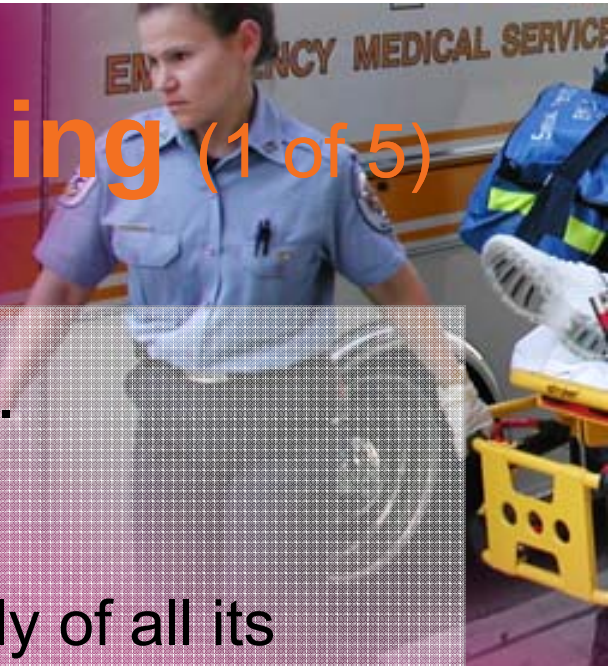
- You must keep the airway clear to ventilate properly.
- Portable, hand-operated, and fixed equipment is essential for resuscitation.



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

Techniques of Suctioning (1 of 5)



- Inspect the equipment regularly.
- To operate the suction unit:
  - Check the unit for proper assembly of all its parts.
  - Test the suctioning unit to ensure vacuum pressure of more than 300 mm Hg.
  - Select and attach the appropriate suction catheter to the tubing.

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.

Techniques of Suctioning (3 of 5)

- When patients have secretions or vomitus that cannot be suctioned easily:
  - Remove the catheter from the patient's mouth.
  - Log roll the patient to the side.
  - Clear the mouth carefully with a gloved finger.

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.

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

Source: © Jones and Bartlett Publishers. Courtesy of MIEMSS.

Maintaining the Airway (2 of 3)

- Take the following steps:
  - Roll the patient onto the left side so that the head, shoulder, and torso move at the same time without twisting.
  - Place the patient's extended left arm and right hand under his or her cheek.
- Not appropriate for patients with suspected spinal injuries

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.

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.

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.

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.

Supplemental Oxygen (6 of 9)

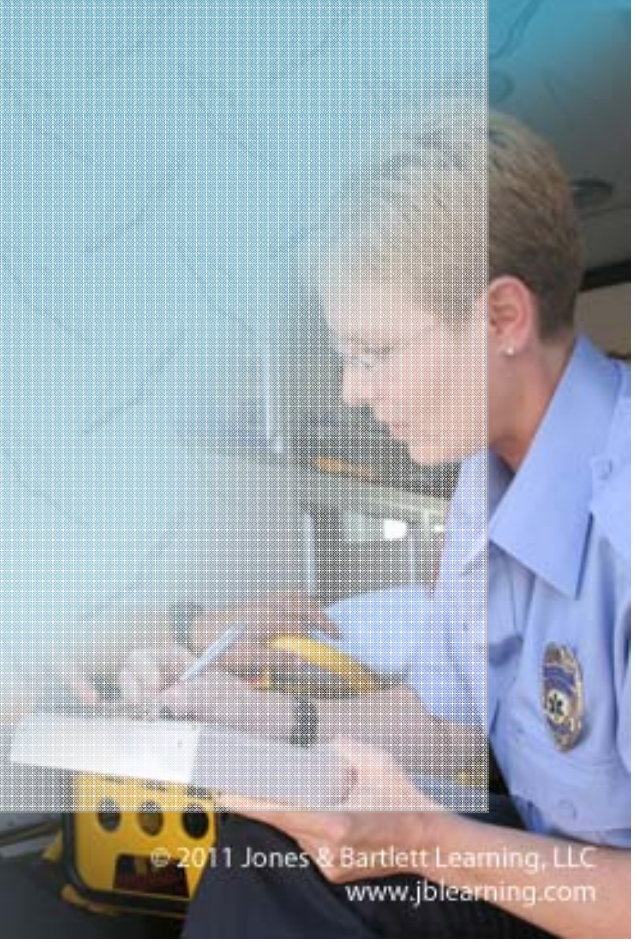
- Pressure regulators
  - Reduce the cylinder's pressure to a useful therapeutic range
  - Usually 40 to 70 psi
  - Final attachment for delivering the gas is either a quick-connect female fitting or a flowmeter.

Supplemental Oxygen (8 of 9)

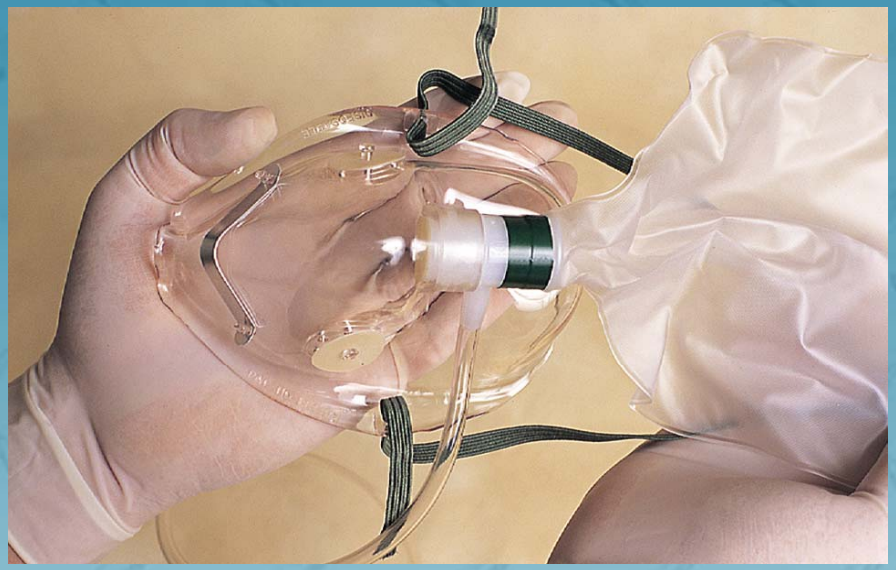
- Hazards of supplemental oxygen:
  - Oxygen does not burn or explode but it speeds up the combustion process.
    - A small spark, such as a glowing cigarette, can become a flame.
  - Keep any sources of fire away.
  - Make sure the area is adequately ventilated.
  - Never leave an oxygen cylinder standing unattended.

Oxygen-Delivery Equipment

- Nonrebreathing masks
- Bag-mask devices
- Nasal cannulas



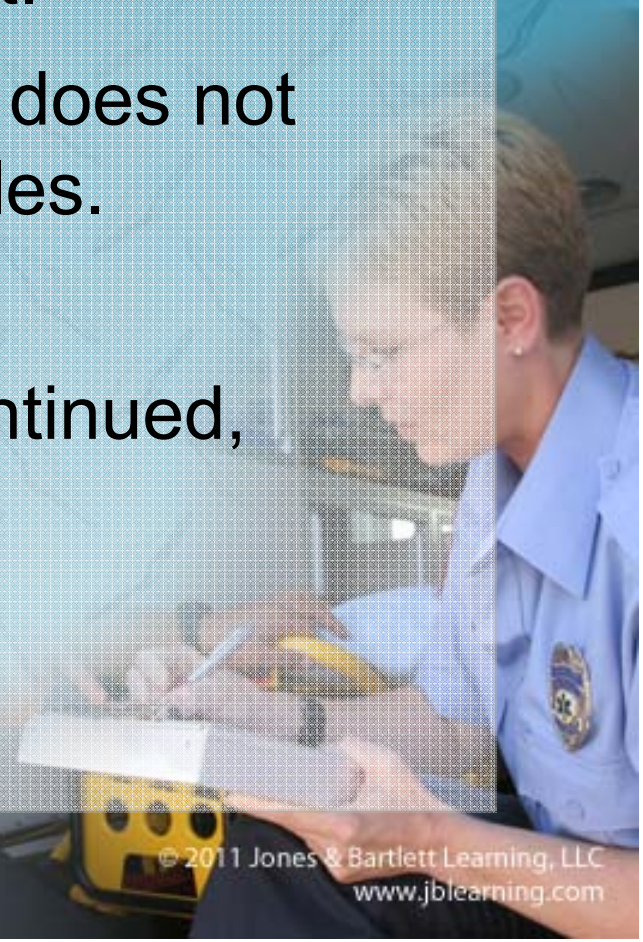
Nonrebreathing Masks (1 of 2)



- 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

Nonrebreathing 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.

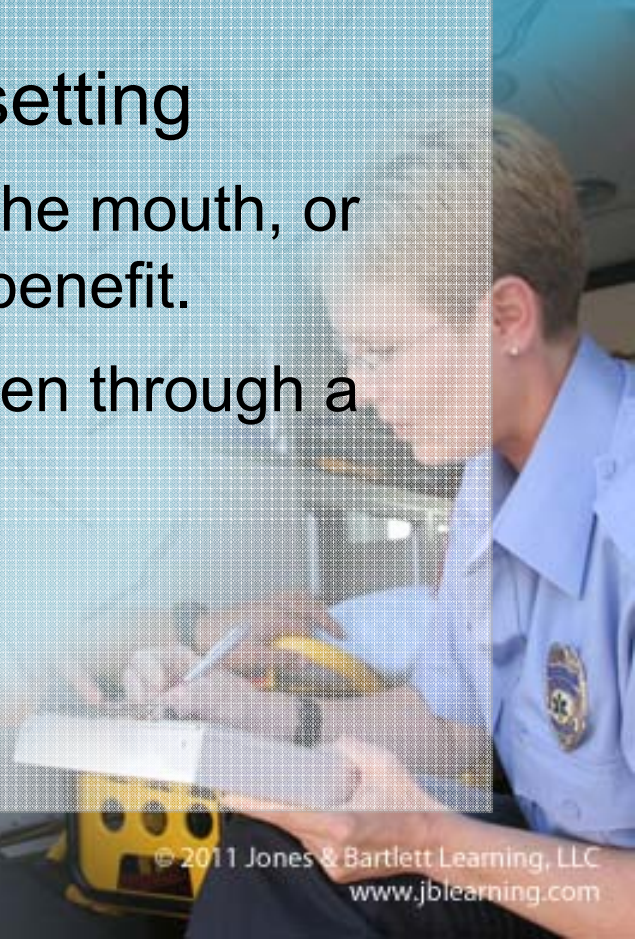


Nasal Cannulas (1 of 2)

- 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

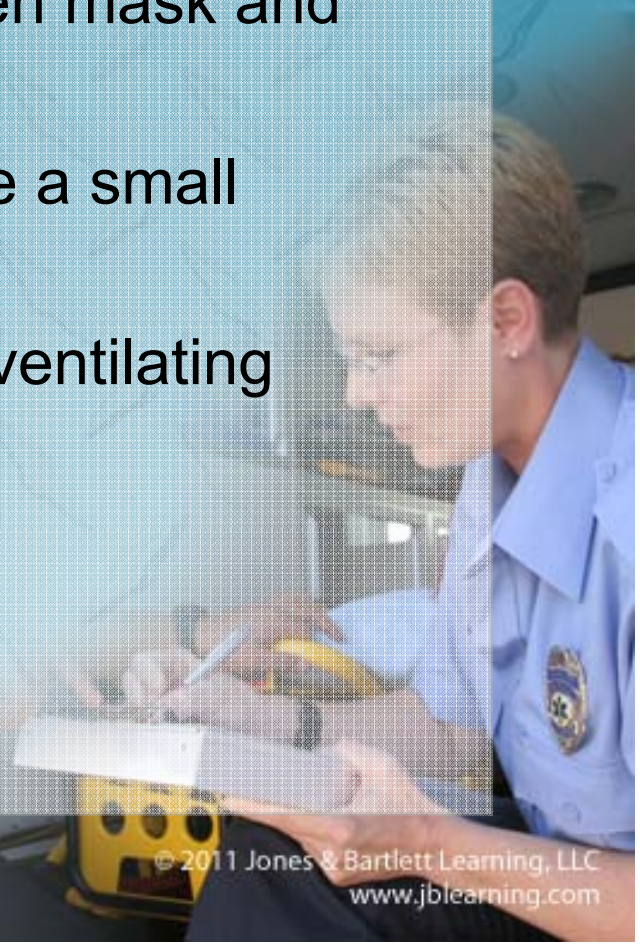
Nasal Cannulas (2 of 2)

- 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.

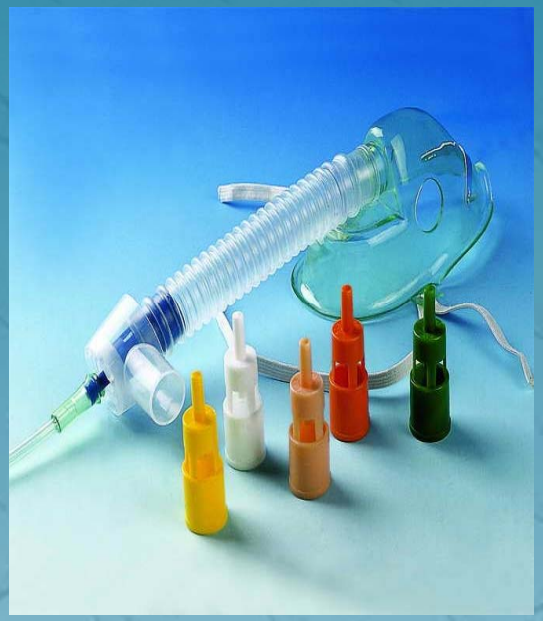


Partial Rebreathing Masks

- 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



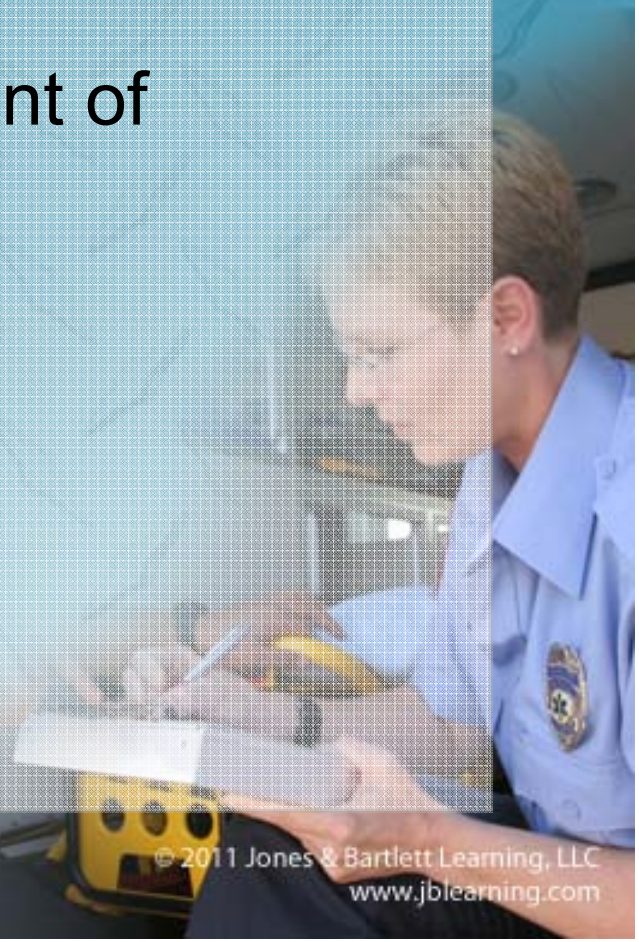
Venturi Masks (1 of 2)



- 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

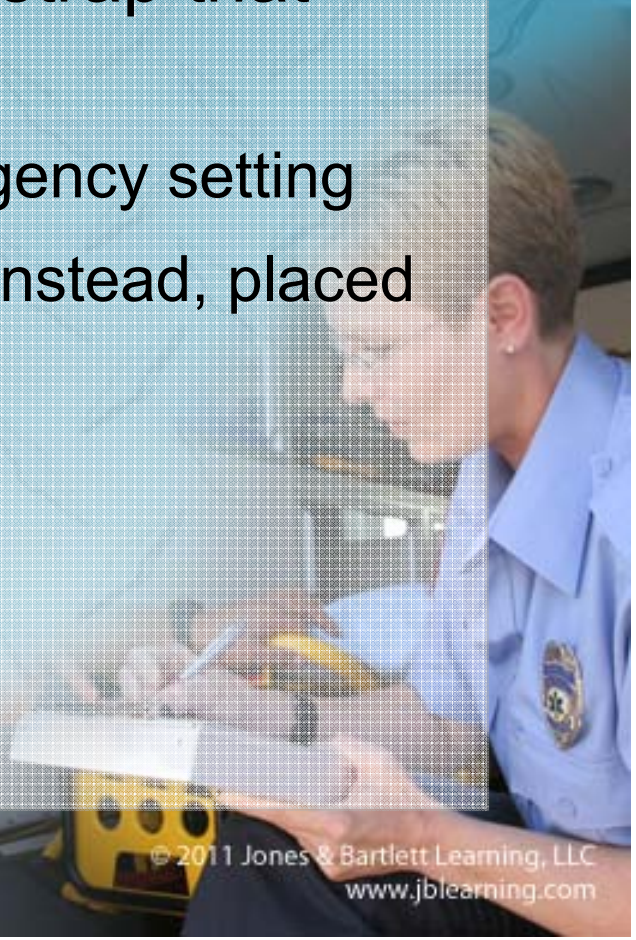


Tracheostomy Masks (1 of 2)

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

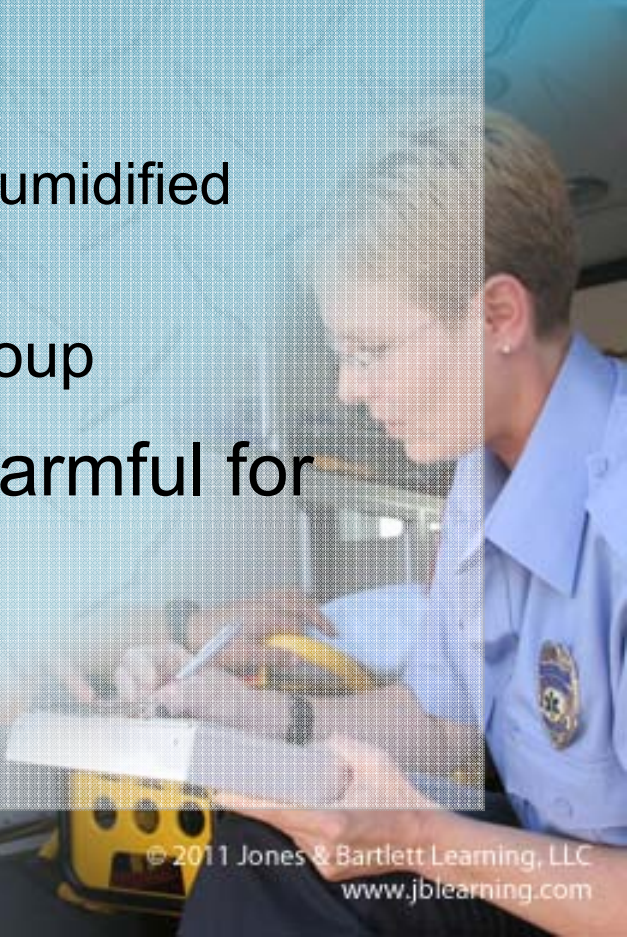
Tracheostomy Masks (2 of 2)

- 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.



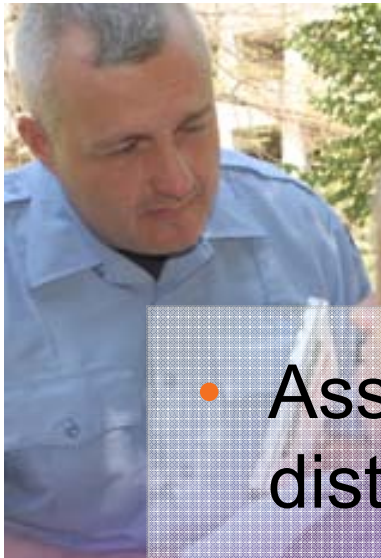
Humidification

- 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.



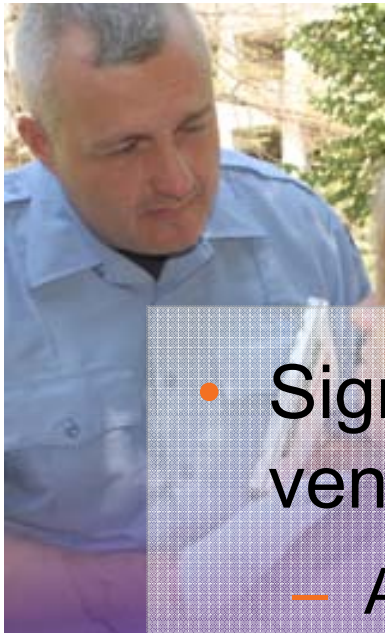
Assisted and Artificial Ventilation (1 of 18)

- 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.



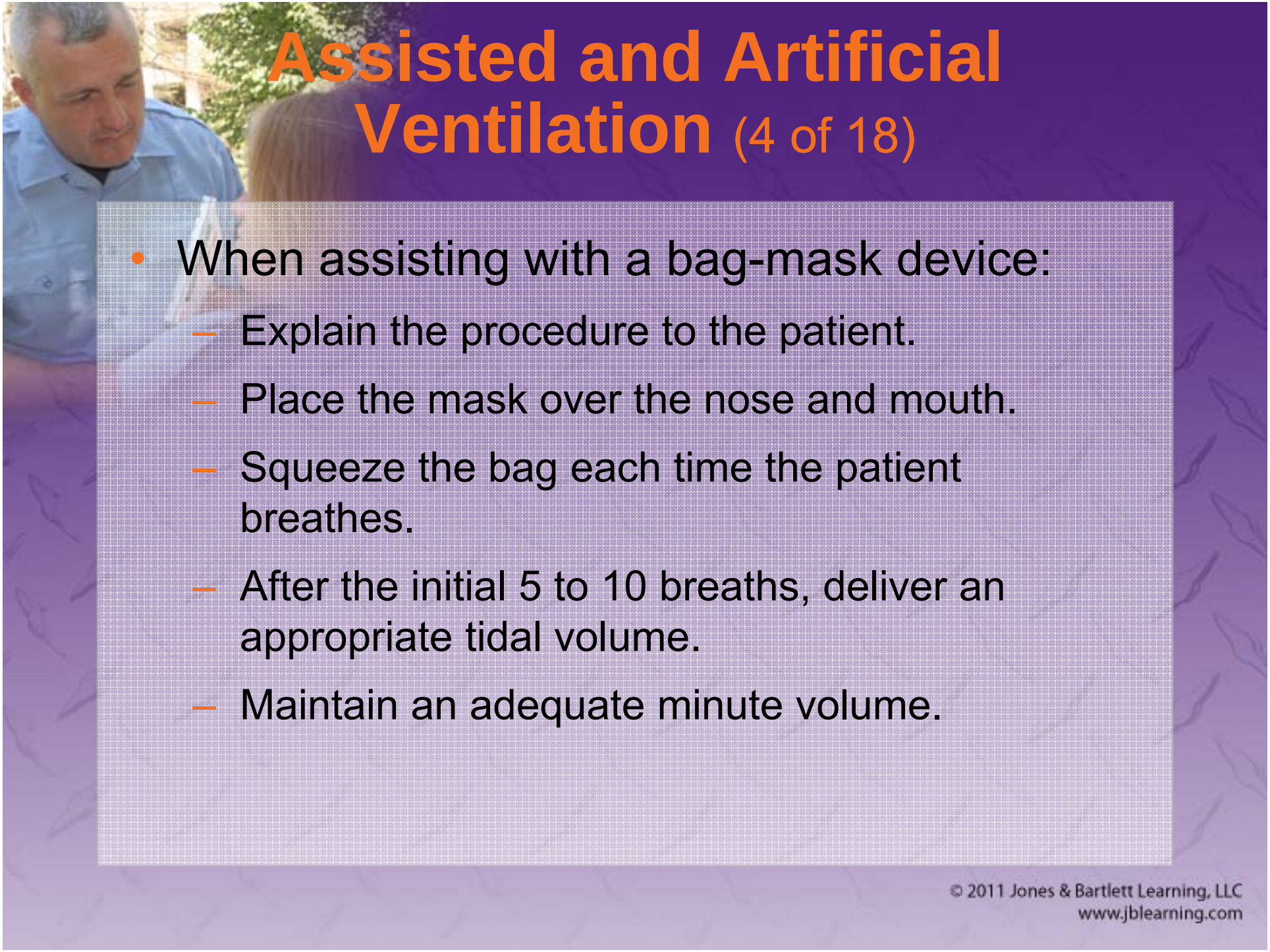
Assisted and Artificial Ventilation (2 of 18)

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



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



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.

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

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.

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.

A manually triggered ventilation device can provide up to 100% oxygen.

Figure 09.43

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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

The Sellick maneuver, also called cricoid pressure, will help prevent or alleviate gastric distention when artificial ventilations are being performed.

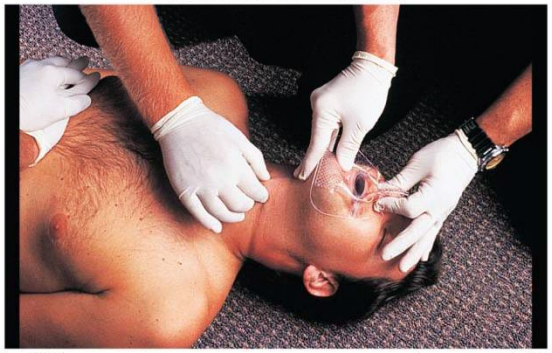

Figure 09.42

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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

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.

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.

Assisted and Artificial Ventilation (15 of 18)

Maintain the seal of the mask to the face using the EC-clamp method if you must ventilate alone.

Figure 09.41

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

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

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

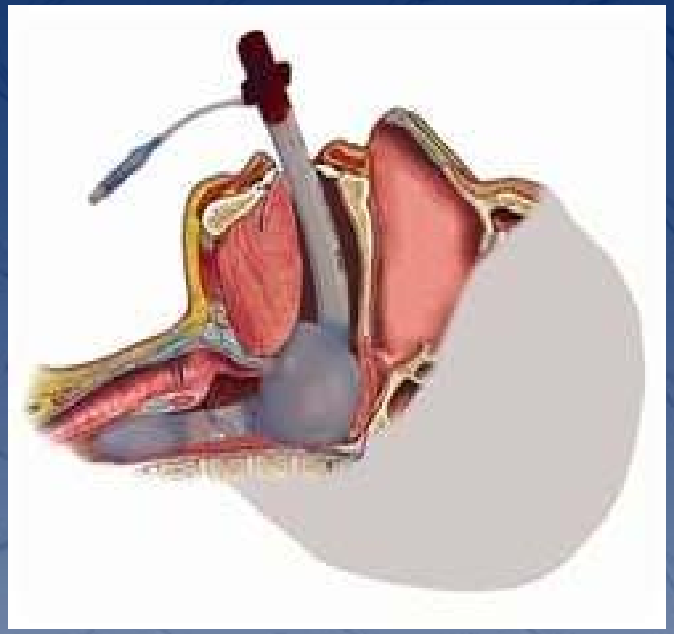
Assisted and Artificial Ventilation (18 of 18)

- 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

Supraglottic Airways

- King LT
- Combitube
- PTL
- LMA

King LT



Combitube

PtL / LMA

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

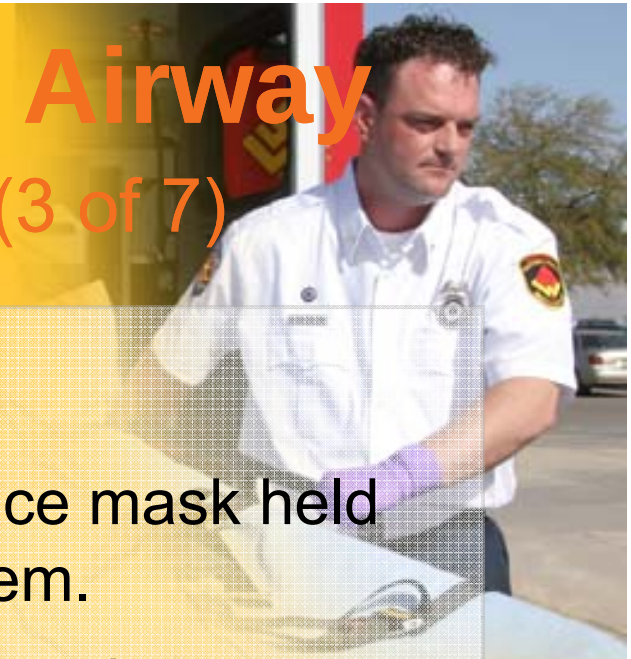
- Noninvasive ventilatory support for respiratory distress
  - Many people diagnosed with obstructive sleep apnea wear a CPAP unit at night.
  - Becoming widely used at the EMT level

Courtesy of Alan Heckman, BS, NREMT-P, NCEE

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

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

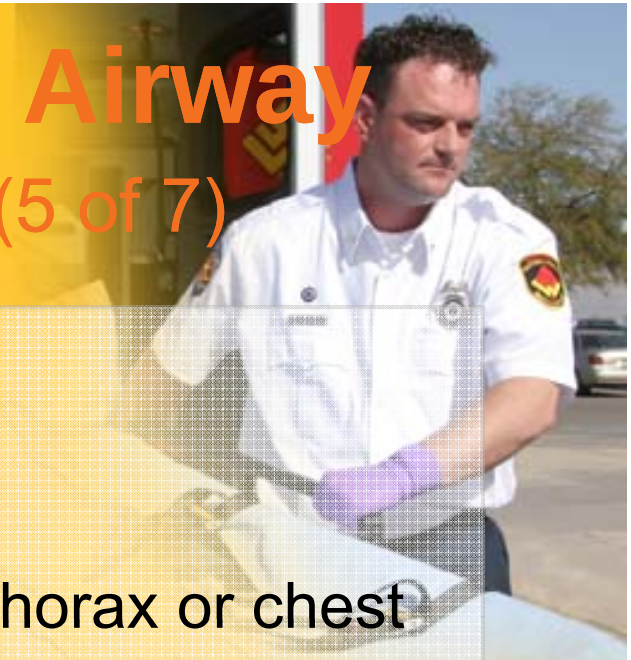


- Mechanism (cont'd)
  - Therapy is delivered through a face mask held to the head with a strapping system.
  - Use caution with patients with potentially low blood pressure.

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%.

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

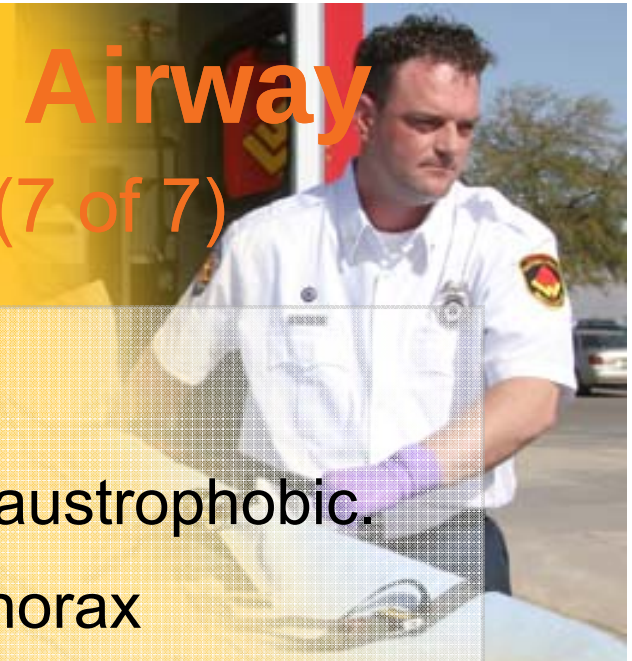


- Contraindications
  - Patient in respiratory arrest
  - Signs and symptoms of pneumothorax or chest trauma
  - Patient who has a tracheostomy
  - Active gastrointestinal bleeding or vomiting
  - Patient is unable to follow verbal commands.

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_2O is acceptable.

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.

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

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 and perform rescue breathing.

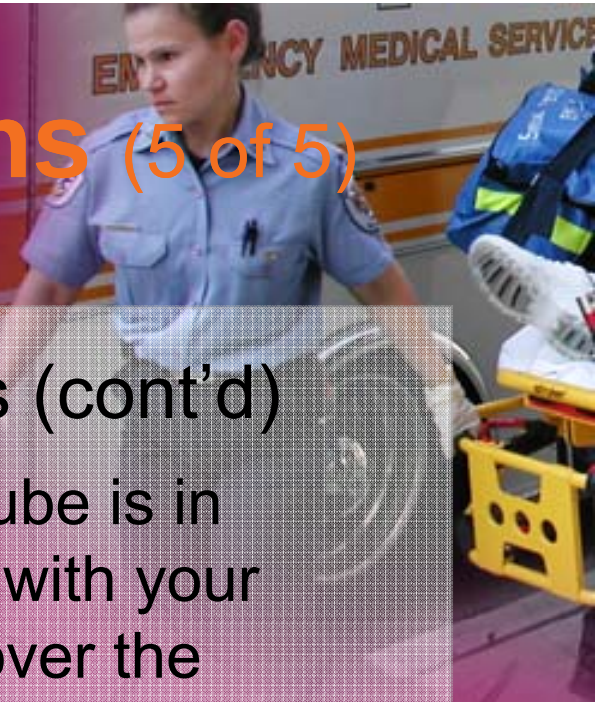
Special Considerations (3 of 5)

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

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.

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.

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.

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)

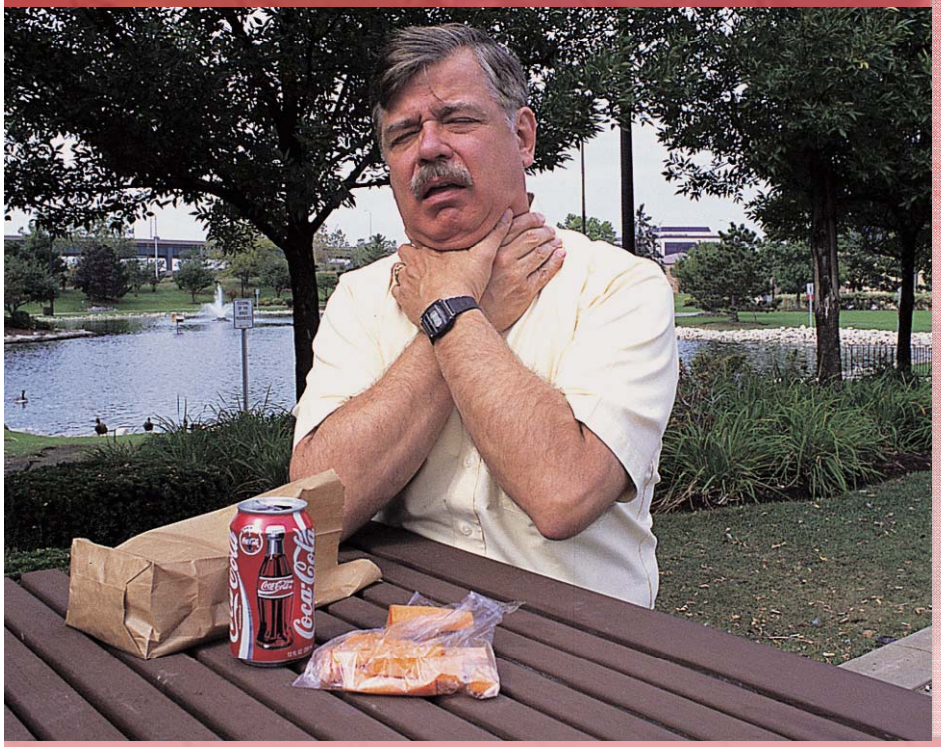
Foreign Body Airway Obstruction (3 of 7)

- 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.

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.

Foreign Body Airway Obstruction (5 of 7)



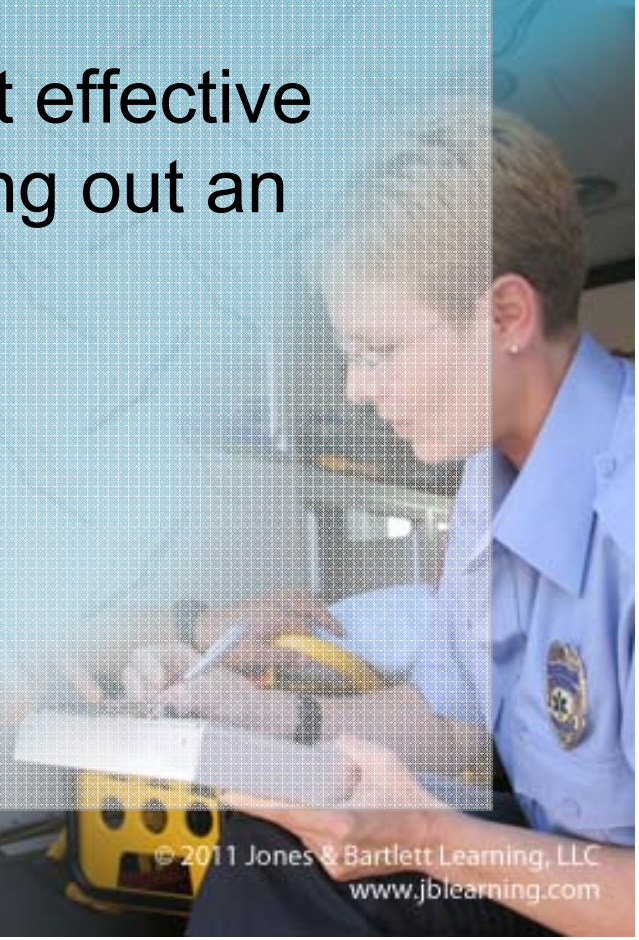
- Severe airway obstruction
  - Patients cannot breathe, talk, or cough.
  - Patient may use the universal distress signal, begin to turn cyanotic, and have extreme difficulty breathing.

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.

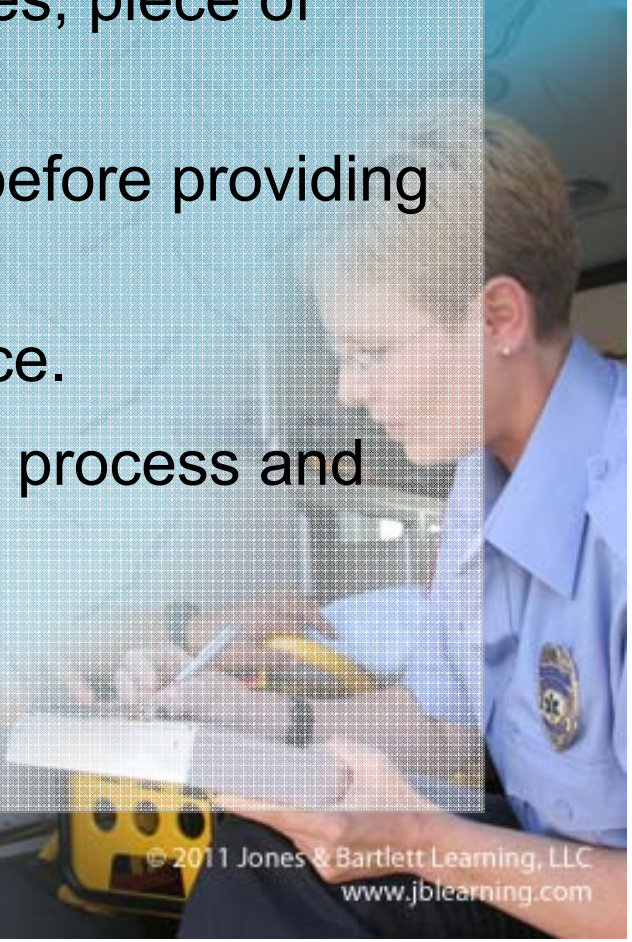
Emergency Medical Care for Foreign Body Airway Obstruction

- 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.



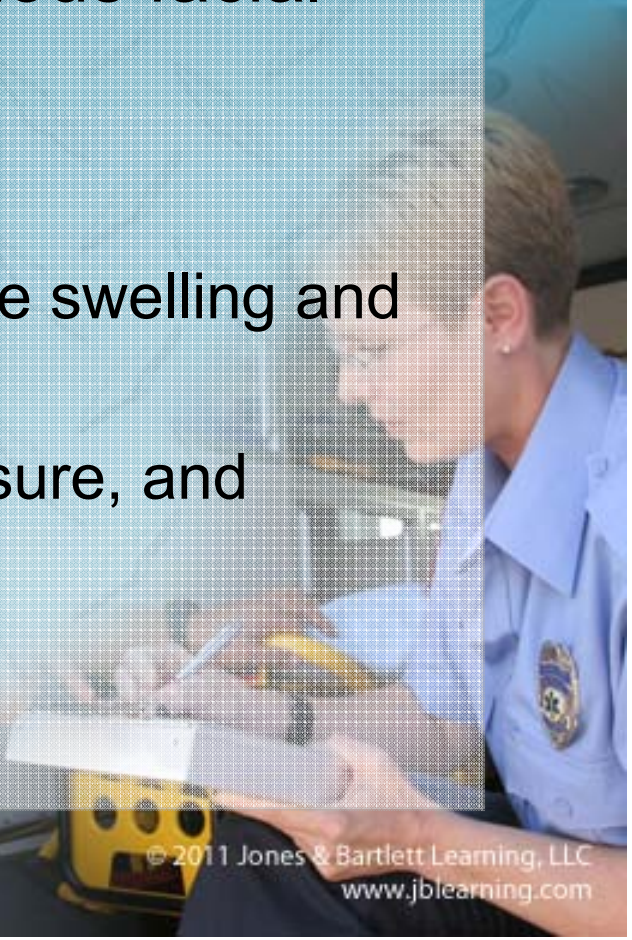
Dental Appliances

- 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.



Summary (1 of 9)

- The upper airway includes the nose, mouth, jaw, oral cavity, pharynx, and larynx. Its function is to warm, filter, and humidify air as it enters the nose and mouth.
- The lower airway includes the trachea and lungs, and its function is to exchange oxygen and carbon dioxide.

Summary (2 of 9)

- Patients who are breathing inadequately show signs of hypoxia, a dangerous condition in which the body's tissues and cells do not have enough oxygen.
- Patients with inadequate breathing need to be treated immediately.

Summary (3 of 9)

- Basic techniques for opening the airway include the head tilt–chin lift maneuver or, if trauma is suspected, the jaw-thrust maneuver.
- Suctioning is the next priority after opening the airway.

Summary (4 of 9)

- The recovery position is used to help maintain the airway in patients without traumatic injuries who are unconscious and breathing adequately.
- You must provide immediate artificial ventilations with supplemental oxygen to patients who are not breathing on their own.

Summary (5 of 9)

- The pin-indexing safety system features a series of pins on a yoke that must be matched with holes on the valve stem of the gas cylinder.
- Pressure regulators reduce the pressure of gas in an oxygen cylinder to between 40 and 70 psi.

Summary (6 of 9)

- The methods of providing artificial ventilation include mouth-to-mask ventilation, two-person bag-mask device ventilation, manually triggered ventilation device, and one-person bag-mask ventilation.

Summary (7 of 9)

- CPAP is a noninvasive method of providing ventilatory support for patients in respiratory distress or suffering from sleep apnea.
- Patients with a tracheal stoma or tracheostomy tube need to be ventilated through the tube or stoma.

Summary (8 of 9)

- Foreign body airway obstruction usually occurs during a meal in an adult; in a child it usually occurs while eating, playing with small objects, or crawling about the house.
- The earlier you recognize an airway obstruction, the better.

Summary (9 of 9)

- Patients with a mild airway obstruction are able to move adequate amounts of air and should be left alone.
- Patients with a severe airway obstruction cannot move any air at all and require immediate treatment.

Review

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

Review

Answer: B

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

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.

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.

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.

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.

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.

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).

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.

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.

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

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.

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.

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.

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.

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.

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.

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).

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.
    C. increase the rate and volume of your ventilations.
    D. decrease your ventilation rate but use more volume.

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.

Questions?

That's All Folks!

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