## Pre-Lecture

# I. You are the Provider

Time: 10 minutes

Small Group Activity/Discussion

### Purpose

This activity is designed to help introduce your students to the content of this chapter.

### Instructor Directions

1. Direct students to read the "You are the Provider" scenario found throughout Chapter 26.
2. You may wish to assign students to a partner or a group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions.
3. You may also assign this as an activity and ask students to hand in their comments on a separate piece of paper.

## Lecture

# I. Review of Respiratory Anatomy and Function

Time: 5 minutes

Slides: 2–4

Lecture

### A. Overview

1. Primary components often compared to an inverted tree
   a. Trachea representing trunk
   b. Alveoli resembling tree's leaves

### B. Upper Airway

1. Air enters primarily through the nares (nostrils).
   a. At any given time one nostril is more open than the other.
2. After passing through the nares, air is pulled over the turbinates.
   a. Ridges covered with mucous membrane
   b. Filter and humidify air
3. Mouth and oropharynx
   a. Angioedema is an allergic reaction that may cause severe swelling of the tongue and lips.

 

4. The oropharynx and nasopharynx meet in the back of the throat at the hypopharynx.
    a. Gag reflex can cause vagal bradycardia (a slow heartbeat caused by stimulation of the vagus nerve), vomiting, and increased intracranial pressure.
5. Larynx (voicebox) and glottis (opening at the top of the trachea)
    a. Considered the dividing line between the upper airway and the sterile lower airway
    b. Thyroid cartilage is the most obvious external landmark of the larynx.
    c. The glottis and vocal cords are found in the middle of the thyroid's cartilaginous structure.
6. Intubation
    a. Arytenoid cartilages appear as two pearly white lumps at the distal end of each vocal cord.
    b. Piriform fossa: a pocket formed by tissue on either side of the glottis
7. Epiglottis
    a. Covers glottic opening
8. Cricoid cartilage
    a. Complete ring that maintains the trachea
    b. Pressing on the anterior portion compresses the esophagus while keeping the trachea open.
9. Cricothyroid membrane
    a. Small space between thyroid and cricoid cartilages
    b. Covered only by skin and minimal subcutaneous tissue
    c. Potential site for performing a cricothyrotomy if you are unable to secure the airway with an advanced airway device
10. Trauma or swelling can create a life-threatening airway obstruction.

## C. Lower Airway

1. Alveoli
    a. Inspired air distributed by a network of conducting airways
    b. Wasted ventilation is called anatomic dead space.
2. Trachea
    a. Trunk of these tubes
    b. Forks into the right and left mainstem bronchi (right branches at a less acute angle in most adults)
3. Bronchi
    a. Lobar bronchi, segmental bronchi, subsegmental bronchi, and bronchioles
    b. 15 branchings, lined with cilia (little hair-like structures that help move matter up and out of the airway)
    c. Goblet cells found in the lining of the airways (blanket of mucus that covers the lining of the conducting airway forming a two-layered blanket that is thick at the surface and thin and watery next to the cilia)
4. Smooth muscle
    a. Surrounds the conducting airways down to the subsegmental level

 

b. Bronchoconstriction occurs on constriction of these muscles.
c. Wheezing resolved with bronchodilator medication was probably caused by these muscles.

5. Terminal airways
   a. Include branches 16 through 24 of the tracheobronchial tree (terminal bronchioles)
   b. Transfer of oxygen and carbon dioxide takes place across both the alveoli and the terminal bronchioles.
   c. Alveoli cluster around the terminal bronchioles.
   d. Gas transfer is most efficient in the alveoli, but a significant amount of gas is exchanged across the respiratory bronchioles.
   e. Once foreign material gets into the terminal bronchioles and alveoli, it typically never comes out.
   f. Alveoli are lined with a substance known as surfactant that reduces surface tension and helps keep the alveoli expanded. (Atelctasis is the collapse of the alveoli.)

# II. Airway Problems Versus Breathing Problems

| Time: 5 minutes |
|---|
| Slides: 5–7 |
| Lecture |

## A. Overview

1. An open airway does not ensure that an adequate volume of gas is moving into and out of the lungs.
2. Increasing the amount of available oxygen ensures that even a patient who is not moving adequate volumes of gas can still maintain adequate oxygen saturation.

## B. Ventilation Revisited

1. Many airway problems can be bypassed by inserting an ET tube.
   a. Alterations in breathing can be more complex.
   b. Conducting airway problems (asthma or bronchitis)
   c. Difficulty at the alveolar level (pneumonia or emphysema)
   d. Problems with the muscles and nerves that make breathing work (Guillain-Barré syndrome or spinal cord injury)
   e. Problems with the rigid structure of the thorax (flail chest)
2. Usually negative-pressure breathers (air suckers)
   a. Negative-pressure vacuum effect because the thorax is essentially an airtight box with a flexible diaphragm at the top
   b. The diaphragm flattens, the overall size of the container increases, and air is sucked in through the tube at the top to fill the increasing space inside the thorax.
   c. Holes in the thorax provide another place for air to be sucked in, resulting in a sucking chest wound.
   d. In positive-pressure ventilation, air is forced into the upper airway and flows into both the trachea and the esophagus (physiologically opposite of normal breathing).

 

e. Exhalation is a passive process. (With asthma, reactive airway disease, or COPD, however, it is no longer a passive process.)

3. Respiratory centers
   a. Most are in and around the brain stem
   b. Cheyne-Stokes respirations (high-brain function), deep sleepers, or intoxicated people will exhibit a depth of breathing (volume of snoring) that gradually increases, then decreases, followed by an apneic period.
   c. Hering-Breuer reflex: cough if you take too deep a breath; caused by stretch receptors in the lungs.

### C. Respiration Revisited

1. Respiration is the process by which oxygen is taken into the body, distributed to the cells, and used by the cells to make energy,
2. Uses oxygen and glucose to make energy that allows the cell to do its work
3. Delivery of oxygen to the bloodstream and removal of the waste carbon dioxide from the body
4. Hypoxia, acidosis, and alkalosis

## III. A Systems Approach to Respiratory Emergencies

| |
|---|
| Time: 10 minutes |
| Slides: 8–12 |
| Lecture |

### A. Neurologic Status

1. The brain is very sensitive to reduced levels of oxygen.
   a. Any alteration in consciousness could represent a degree of respiratory compromise.
   b. Anxiety can be an early sign of hypoxia; confusion, lethargy, and coma are later signs. Dizziness and tingling extremities could signify hyperventilation.
2. Brain trauma may depress the respiratory control centers in the medulla.
   a. Intracranial pressure in closed head trauma may squeeze the medulla to produce a variety of respiratory abnormalities.
   b. Stroke deprives portions of the brain of circulation.
   c. Overdose with drugs (narcotics or barbiturates) may also depress activity of the respiratory center.
3. Injury high in the spinal cord may paralyze the intercostal muscles and even the diaphragm.

### B. Cardiovascular Status

1. Think of the lungs as lying between the right and left sides of the heart (in terms of function).
   a. The right side of the heart pumps blood to the lungs, while the left side receives blood from the lungs and pumps it around the body.
2. Mild hypoxemia results in increased heart rate.

 

3. Severe hypoxia often causes bradycardia.

### C. Muscles and Mechanics

1. People who have asthma can often compensate for their respiratory distress by devoting lots of energy to their breathing.
   a. They can maintain oxygen and carbon dioxide levels in an acceptable range as long as they continue to apply their muscles to this effort.
   b. Tremendous amounts of energy
   c. At some point they tire out and are unable to continue doing the necessary work of breathing (look sleepy, rate and depth of respirations will slowly drop, decompensation).
2. Mechanical interference
   a. Trendelenburg position or even laying the patient flat may cause abdominal organs to push against the diaphragm.
   b. Most people seek a sitting position when they are short of breath (orthopnea).

### D. Renal Status

1. Fluid balance, acid-base balance, and blood pressure are controlled by the kidneys.
   a. Each affects the pulmonary mechanics and the delivery of oxygen to tissues.

### E. You are the Provider

Slide: 13

Discussion

1. Present the case study provided on the slide:
   a. You and your partner are dispatched to the private residence of an 87-year-old in respiratory distress.
   b. You arrive on scene and find a woman who is in the tripod position and appears to be in moderate respiratory distress.
   c. She is conscious, alert, and speaking in three- to four-word sentences.
   d. Respiratory distress calls will be very common for paramedics, especially in older people. Remember, sometimes they will be poor historians and will not be able to tell you specifically what is wrong. They take the words of their doctors and generally do not ask questions. So if the doctor gives her a nebulizer, she will not question why, but will just take it.

## IV. Assessment of the Patient With Dyspnea

Time: 25 minutes

Slides: 14–28

Lecture

### A. Initial Assessment

1. Body type association with a particular pathologic condition

 

   a. Emphysema: barrel chest (bigger in the front-to-back dimension than in the side-to-side dimension), muscle wasting (patient has cannibalized his or her own body mass for energy), and pursed-lip breathing
   b. Chronic bronchitis: tend to be more sedentary (may be obese), often encountered in a chair or recliner (sleep in an upright position)
   c. End-stage diseases: sickly appearance, rigors, and chills

2. Position and degree of distress
   a. Tend to seek the sitting position
   b. Tripod position involves leaning forward and rotating the scapulae outward by placing the arms on a table or by placing the hands on the knees.
   c. Purposeful hyperextension occurs when a patient maximizes airflow through the upper airway (hold their head in the head tilt-chin lift or "sniffing" position).
   d. Head bobbing frequently is preterminal behavior.
3. Work of breathing
   a. Patients using lots of muscles to breathe are in danger of tiring out.
   b. Bony retractions: most common in children, in whom the rigid structure of the thorax is still flexible. On inhalation the child may pull (or retract) the sternum or ribs into the chest, causing a visible deformity with each breath.
   c. Soft-tissue retractions: during inhalation in the supraclavicular, intercostal, and subxiphoid areas
   d. Nasal flaring: nostrils pulled wide open on inhalation
   e. Tracheal tugging: thyroid cartilage is pulled upward and the area above the sternal notch is sucked inward with inhalation.
   f. Paradoxical respiratory movement: epigastrium is pulled in with inhalation while the abdomen pushes out, creating a see-saw appearance as the two move in opposing directions.
   g. Pulsus paradoxus: profound intrathoracic pressure changes causing peripheral pulses to weaken on inspiration
   h. Assess breathing for rate and depth (difficulty).
   i. See Table 26-1 for the inspiratory-to-expiratory (I:E) ratio.
   j. Any respiratory noises you can hear without a stethoscope are abnormal noises.
   k. Quiet breathing may indicate hyperventilation syndrome, acidosis, or shock.
4. Neurological assessment
   a. Level of consciousness
   b. Any decline in arterial $PO_2$ will manifest initially as restlessness, confusion, or combative behavior.
   c. An increase in $PCO_2$ has sedative effects.
5. Skin color
   a. Fast way to begin forming an early impression of the patient's condition
   b. Tissue inside the mouth, under the eyelids, and even under the nail beds is usually the same pink color in all healthy patients.
   c. Cyanosis: blue discoloration resulting from desaturated blood cells

 

d. Chocolate brown skin: high levels of methemoglobin derived from nitrates and some toxic exposures may turn the mucous membrane brown (more evident in the venous blood than in the skin).
e. Pale skin: reduction of blood flow to the small vessels near the surface of the skin

## B. The Focused History: Elaboration on the Chief Complaint

1. Reason for calling for help
   a. Patients with chronic respiratory conditions are often knowledgeable about their condition and past treatments.
2. Onset and duration
   a. Rapid-onset dyspnea may be caused by acute bronchospasm, anaphylaxis, pulmonary embolism, or pneumothorax.
   b. Paroxysmal nocturnal dyspnea: occurs suddenly in the middle of the night (ominous sign); may indicate left heart failure, worsening of COPD, or both
   c. Position of comfort and difficulty breathing may help gauge the degree of distress.
3. History of the problem
   a. Repeating conditions
   b. Serve as a baseline for current complications
4. Attempts at treatment
   a. Patients may already have strategies to manage crisis.
5. Associated symptoms
   a. Respiratory difficulty must always be evaluated in light of the patient's cardiovascular and renal status.
   b. The vast majority of chronically ill patients have a respiratory component to their disease.

## C. The Focused Physical Exam

1. Neck exam
   a. Look for jugular venous distention (engorged with blood).
   b. Note the trachea: Tracheal deviation is a classic sign of a tension pneumothorax.
2. Chest and abdominal exam
   a. Hepatojugular reflux is specific to right heart failure.
   b. Feel the chest for vibrations (tactile fremitus) as the patient breathes.
3. Exam of the extremities
   a. Edema of the ankles or lower back
   b. Skin temperature (fever or cool and clammy)

## D. Data Collection

1. Stethoscope
   a. The longer the tubing, the more extraneous noise you will hear.
   b. The diaphragm of the stethoscope is for high-pitched sounds; the bell is for low-pitched sounds.
2. Auscultation
   a. Lungs are not symmetrical.

 

b. Some of the pathologic conditions you will listen for are gravity-dependent.

3. Specific breath sounds
   a. Tracheal breath sounds are not commonly auscultated.
   b. Bronchial breath sounds are also quite loud, but exhalation predominates.
   c. The most commonly heard breath sounds are soft, breezy vesicular sounds heard in the periphery.
   d. Sounds move better in fluid than in air; the more air present the more distant, diminished, or absent the breath sounds will be.
   e. Quality of the breath sounds depends on how much extra tissue you must listen through.
   f. If a patient speaks while you are auscultating the chest, you cannot usually understand what he or she is saying; if you can it may mean consolidation from pneumonia or atelectasis.
   g. Adventitious (abnormal) breath sounds are the extra noises that you may hear on top of the breath sounds. (Continuous sounds can be heard across some portion of each breath. Discontinuous sounds are the instantaneous pops, snaps, and clicks that we often identify as crackles.)
   h. The most ominous breath sounds are no breath sounds.
4. Sputum
   a. Smokers or patients with chronic respiratory diseases cough up sputum every day.
   b. Note changes in color or amount.
   c. Blood-tinged sputum may be a warning sign of tuberculosis or pulmonary edema.

## E. Monitoring Devices

1. Pulse oximetry
   a. Noninvasive device that tells us what percentage of the patient's hemoglobin has oxygen attached to it.
   b. Does not recognize the difference between oxygen and carbon monoxide
   c. The oxyhemoglobin dissociation curve describes the relationship between oxygen saturation and oxygen dissolved in the plasma.
2. End-tidal carbon dioxide detector
   a. Colorimetric detecting does not measure the exact amount of carbon dioxide exhaled, but it does indicate whether carbon dioxide is present in reasonable amounts in the exhaled breath.
   b. Helps identify placement of an ET tube; if the tube has been mistakenly placed in the esophagus less than 0.5% carbon dioxide will be present in exhaled gas.
   c. Confirm the reading over at least six breaths. (Carbon dioxide may be trapped in the stomach from carbonated beverages.)
3. Peak expiratory flow
   a. Maximum flow rate at which the patient can expel air from the lungs

## F. You are the Provider (continued)

| Slide: 29 |
| --- |
| Discussion |

 

1. Continue presenting the case study provided on the slide:
    a. Your partner listens to her breath sounds and hears wheezing throughout, and her lungs are very diminished.
    b. Her pulse rate is tachycardic at a rate of 118 beats/min; her blood pressure is 130/74 mm Hg; skin is warm, dry, and normal in color.
    c. *What do you need to know about this patient?*
        - You should immediately suspect an exacerbation of COPD or possibly pneumonia, from the fact that she is in the tripod position and has wheezing. You want to ask her or her family about her history and medications.

# V. Upper Airway Obstruction

Time: 10 minutes

Slides: 30–33

Lecture

## A. Anatomic Obstruction

1. The most common cause in the semiconscious or unconscious patient is the tongue.
    a. If the patient is snoring, take away the pillow and reposition the patient's airway.
2. Excess soft tissue in the airway is one cause of obstructive sleep apnea.
    a. Some people go so far as to have tissue surgically removed from their pharynx to limit this anatomic obstruction .

## B. The Hot (Infected) Airway

1. Croup
    a. Viral infection of the upper airway
    b. Most common in small children
2. Tonsillitis

## C. Aspiration

1. Aspirating stomach contents into the lungs carries a significantly high mortality rate.
    a. Common but profoundly dangerous complication
2. Treatment guidelines
    a. Aggressively reduce the risk of aspiration by avoiding gastric distention when ventilating and by decompressing the stomach with an NG tube whenever appropriate.
    b. Aggressively monitor the patient's ability to protect his or her own airway, and seek to protect the patient's airway with an advanced airway if this is impossible.
    c. Aggressively treat aspiration with suction and airway control if steps a and b fail!
3. If basic life-support maneuvers fail, use laryngoscopy and Magill forceps.
    a. If necessary perform a needle or surgical cricothyrotomy.

 

# VI. Obstructive Airway Diseases

Time: 15 minutes

Slides: 34–43

Lecture

## A. Overview

1. Characterized by diffuse obstruction to airflow within the lungs
2. Most common diseases are emphysema, chronic bronchitis, and asthma.
   a. These three affect 10% to 20% of adults in the United States.
3. Occurs when positive pressure of exhalation causes small airways to pinch shut, trapping gas in the alveoli
   a. Large amounts of gas trapped in their lungs that they can't effectively expel
   b. If they push the gas out slowly at a low pressure, they can exhale more than if they try to push it out hard and fast.
4. May demonstrate a variety of physical findings
   a. Pursed-lip breathing: allows breath out slowly under controlled pressure
   b. Increased inspiratory-to-expiratory (I:E) ratio: 1:2 in healthy people, 1:6 or 1:8 in obstructive patients
   c. Abdominal muscle use: patients with an obstructive disease must work to push air out with every breath.
   d. Jugular venous distention: trapped air causes higher pressure in the thorax.

## B. Asthma

1. Second-century Greek physician Aretaeus
   a. "Because in the paroxysms, the patients also pant for breath."
2. Characterized by an increased reactivity of the trachea, bronchi, and bronchioles to a variety of stimuli.
   a. Hyperreactivity results in widespread, reversible narrowing of the airways (reactive airway disease).
   b. Edema of the airways and increased mucous production can cause significant airway obstruction.
3. Acute attacks of variable duration
4. Fastest-growing asthma rates are observed in children younger than 5.
   a. More common in males; more severe in females.
   b. African Americans (especially in large urban centers) are three times more likely to be diagnosed with asthma and have death rates that are five times higher than those observed in whites.
5. Bronchospasm
   a. Caused by constriction of smooth muscle that surrounds the larger bronchi in the lungs
   b. Stimulation by an allergen or irritants such as dust, perfume, cat dander, or cold temperatures or by other stimuli such as exercise or stress
   c. Air is forced through constricted tubes, causing them to vibrate (wheezing).

 

d. The primary treatment of bronchospasm is a breathing treatment for the administration of bronchodilator medication.

6. Bronchial edema
   a. Turbulent airflow, wheezing, and air tapping
   b. The primary treatment is corticosteroids (takes a few hours).
7. Increased mucous production
   a. Thick secretions may plug the distal airways and contribute to air trapping.
   b. The primary approach to dealing with secretions in asthma is to improve hydration.
   c. Mucolytics (break down thick mucus) or expectorants (loosen thick secretions so they can be coughed out) are sometimes used.
8. Potentially fatal asthma
   a. Severely compromised ventilation all of the time
   b. See Table 26-5: Potentially Fatal Asthma .

## C. COPD

1. Emphysema
   a. Chronic weakening and destruction of the walls of the terminal bronchioles and alveoli
   b. Some congenital enzyme deficiency
   c. The most common cause in the United States is cigarette smoking.
   d. Breakdown of the connective tissue structure of the terminal airways results in groups of alveoli merging into large blebs or bullae. (These collapse far more easily than does normal lung tissue.)
   e. Barrel chest is caused by chronic lung hyperinflation.
2. Chronic bronchitis
   a. Sputum production most days of the month for three or more months out of the year for more than two years
   b. Excessive mucous production in the bronchial tree, accompanied by a chronic or recurrent productive cough (phlegm)
   c. Almost invariably a heavy cigarette smoker, usually somewhat obese, congested, and sometimes has a bluish complexion
3. Typical presentations of COPD
   a. Very sick people, with little or no respiratory reserves
   b. COPD with pneumonia: often get infections in their bronchi and lungs
   c. COPD with right heart failure: difficult to push patient's thick blood through capillaries squashed by hyperinflated alveoli
   d. COPD with left heart failure: AMI or cardiac rhythm disturbance can cause sudden-onset left heart failure.
   e. Acute exacerbation of COPD: no co-pathologic condition accounts for the patient's sudden decompensation.
   f. End-stage COPD: eventually reach a point where lungs simply cannot support oxygenation and ventilation any longer
   g. Hypoxic drive: rare phenomenon that affects only a very small percentage of patients who have the most chronic forms of pulmonary disease

 

h. When a patient has chronic hypoventilation, bicarbonate ions migrate into the cerebrospinal fluid; the primary stimulus to breathe comes from decreased levels of oxygen, not increased levels of carbon dioxide.

4. Administration of oxygen
   a. Only a small subset of patients with COPD breathe because of hypoxic drive, but you cannot tell who they are by looking at them.
   b. Such patients do not suddenly become apneic after a whiff of oxygen. High levels of oxygen slowly depress their respiratory drive.
   c. You can encourage breathing with verbal and physical stimulation.
   d. If a patient becomes apneic because of increased oxygenation, his or her skin may still appear perfused.
   e. If the patient becomes apneic, provide artificial ventilation and consider intubation.
   f. These patients are poor candidates for intubation. If you intubate these patients, you may doom them to live what is left of their life on a ventilator.
   g. Although oxygen saturation may be a valuable adjunct to your decision, $SaO_2$ numbers are a little different for patients with COPD and tell you nothing about their carbon dioxide levels.

# VII. Common Respiratory Presentations

| |
|---|
| Time: 10 minutes |
| Slides: 44–48 |
| Lecture |

## A. Asthma with Fever

1. A typical asthma attack that responds to treatment but occurs again in a few hours is sometimes caused by an underlying infection.

## B. Failure of a Metered-Dose Inhaler

1. Medication may be exhausted while propellant remains.
2. Patient may not know how to properly use the device.

## C. Travel-Related Problems

1. Patient does not want to take their diuretics while traveling.

## D. Dyspnea Triggers

1. Not always possible to avoid known triggers

## E. Seasonal Issues

1. Many things grow in heating ducts and air conditioners during their off-seasons.

## F. Noncompliance With Therapy

1. Chronic respiratory disease patients may rebel against therapy.
   a. Refuse to use medication or treatments or use them only sporadically

## G. Failure of Technology/Running Out of Medicine

 

1. Advances in technology have allowed patients freedom of mobility.
2. Creates new complications

### H. Complications of Over-the-Counter Medications

1. Misusing medication
   a. Antihistamines: common ingredient in many cold medications; dry secretions are not good for asthmatic patients.
   b. Antitussives: cough suppressant; coughing helps clear secretions from the airways.
   c. Bronchodilators; most are weak forms of epinephrine; often nonspecific (may have a significant impact on the heart and blood vessels).
   d. Diuretics: diet pills and caffeine-containing products (beverages containing alcohol or caffeine)

### I. Exertion-Related Problems

1. Oxygen demand increases with any kind of exertion.

## VIII. Other Causes of Respiratory Problems

| |
|---|
| Time: 15 minutes |
| Slides: 49–56 |
| Lecture |

### A. Pulmonary Infections

1. Bacteria, viruses, fungi, mycoplasmas, and a host of other agents cause infections.
   a. The respiratory tract is particularly vulnerable to airborne agents.
2. Infectious diseases cause swelling of the respiratory tissues, an increase in mucous production, and the production of pus.
   a. Swelling in the upper airway can be dramatic.
   b. Pus-filled alveoli contribute to shunt (oxygen does not reach the bloodstream).
3. Pneumonia may be caused by any variety of bacterial, viral, and fungal agents.
   a. Streptococcus pneumoniae bacillus is the most frequent cause of bacterial pneumonia (10% of hospital admissions in the US).
   b. Anyone who is not moving air well or who is immunocompromised is at risk of developing pneumonia.
   c. Patients with acquired immunodeficiency syndrome are particularly susceptible to *Pneumocystis carinii* pneumonia (primary cause of morbidity and mortality in such patients).
4. Patients with pneumonia usually report several hours to days of weakness, productive cough, fever, and sometimes chest pain made worse by cough.
5. Pneumonia often occurs in the lung bases, typically on only one side.
   a. Coughing fit when they roll from one side to the other
   b. Patient's oxygen saturation will be significantly lower if they lay on one side.
6. Often dehydrated

### B. Alveolar Dysfunction

 

1. Alveoli are vulnerable to a number of disorders.
   a. Atelectasis (collapse)
   b. Fill with pus or fluid

## C. Atelectasis

1. Alveoli are more difficult to blow open once they have completely collapsed.
2. In the hospital, patients are constantly encouraged to take deep breaths.

## D. Cancer

1. Lung cancer is one of the most common forms of cancer (especially in cigarette smokers or people exposed to occupational hazards).
2. Tumors in the large airways bleed, causing hemoptysis (blood in the sputum) and uncontrollable coughing.
   a. Frequently accompanied by COPD and impaired lung function
   b. Lungs are also common sites for the metastasis of cancers from other parts of the body.

## E. Toxic Inhalations

1. Type of damage depends on the water solubility of the toxic gas.
   a. Highly water-soluble gas will react with the moist mucous membranes of the upper airways.
   b. Less water-soluble gas may get deeper into the lower airway, where it may do damage over time.

## F. Pulmonary Edema

1. Swelling of the lungs occurs when fluid from the blood plasma migrates into the lung parenchyma.
   a. Compromises gas exchange
2. One of the most common causes is heart failure resulting from a left side AMI.
3. Early, you will hear crackles in the base of the lungs.
4. As it worsens, you may hear crackles higher in the lung fields.

## G. Adult Respiratory Distress Syndrome

1. Shock lung, Da Nang lung, and hyaline membrane disease
2. Caused by diffuse damage to the alveoli
   a. As a result of shock, aspiration of gastric contents, pulmonary edema, or hypoxic events
3. Alveoli stiffen and become difficult to ventilate.

## H. You are the Provider (continued)

Slide: 57

Discussion

1. Continue presenting the case study provided on the slide:
   a. Upon questioning the patient, you find out this started two days ago and she thought it would go away. (She has a history of emphysema.)

 

b. It worsened through the night and she decided to call now.

c. *What are the treatments you need to begin immediately?*

- You should start the patient on a Proventil, possibly with Atrovent. Consider administering an IV of normal saline at a keep-vein-open rate and possibly some Solu-Medrol 125 mg IV push. Make sure you reassess the patient after each treatment.

# IX. Problems Outside the Lung Parenchyma

Time: 5 minutes

Slides: 58–60

Lecture

## A. Pneumothorax

1. Air collects between the visceral and the parietal pleura that line the inside of the chest cavity.
   a. Blebs (weak spots) can rupture under stress, causing a spontaneous pneumothorax.
2. Sharp pain after they cough, followed by increasing dyspnea over the subsequent minutes or hours

## B. Pleural Effusion

1. Fluid collects between the visceral and parietal pleura.
   a. Sac of fluid similar to a blister
2. Can be caused by infections, tumors, or trauma
3. A large effusion will decrease lung capacity.

# X. Disruption of the Pulmonary Circulation

Time: 5 minutes

Slides: 61, 62

Lecture

## A. Overview

1. May be compromised by a blood clot (embolism), a fat embolism from a broken bone, an amniotic fluid embolism from leakage of amniotic fluid, or even an air embolism
   a. A large embolism will lodge in a major branch of the pulmonary artery and act as a plug to prevent any blood flow through that branch.
2. Considered one of the most frequently misdiagnosed conditions in emergency medicine
   a. Not immediately evident that anything is wrong
3. Many come from the large veins in the legs, where clots can form and migrate through the venous circulation.
4. Clots may form when patients are immobile for long periods of time.
   a. Long car trips, lengthy airplane flights

 

b. Bedridden patients are often prescribed anticoagulants or wear special stockings or other devices to reduce the formation of blood clots in their legs.

5. Patients with a history of deep venous thrombosis
   a. A Greenfield filter catches any clots that break loose and travel from the legs.

# XI. Disorders of Ventilation

| |
|---|
| Time: 10 minutes |
| Slides: 63–69 |
| Lecture |

## A. Overview

1. The best measurement of ventilation is the carbon dioxide level.
   a. Directly related to pH

## B. Respiratory Failure Resulting From Hypoventilation

1. Conditions that impair lung function
   a. Patient is breathing but gas exchange is impaired; carbon dioxide levels rise.
   b. Severe cases of atelectasis, pneumonia, pulmonary edema, asthma, or COPD
2. Conditions that impair the mechanics of breathing
   a. High cervical fracture, flail chest, diaphragmatic rupture, severe retractions, an abdomen full of air or blood, abdominal or chest binding, or anything else that impairs the pressure changes that allow breathing can result in reduced gas flow.
   b. Pickwickian syndrome: respiratory compromise secondary to extreme obesity
3. Conditions that impair the neuromuscular apparatus
   a. Head trauma, intracranial infections, or brain tumors
   b. Serious injury to the spinal cord (above C5) may block the nerve impulses that cause breathing to occur.
4. Conditions that reduce respiratory drive
   a. Acute heroin overdose, as well as intoxication with alcohol, narcotics, and other drugs or toxins

## C. Hyperventilation

1. People breathe in excess of metabolic need.
   a. Increasing the rate at which they breathe, the depth they breathe, or both, so much so that their carbon dioxide level begins to fall
   b. Fall of carbon dioxide levels may make the patient feel short of breath.
   c. Acute hyperventilation syndrome: patients feel as if they cannot breathe at all.
   d. Causes respiratory alkalosis (numbness or tingling in the hands and feet and around the mouth)
2. Traditional therapy patients rebreathe their own carbon dioxide (dangerous).
   a. Patients quickly exhaust the oxygen in the gas they are breathing.
   b. An acidotic patient might be hyperventilating in an attempt to drive their pH level down to normal levels.

 

3. Treatment may include sedating the truly hysterical hyperventilator.
4. Emotional stressor
    a. Psychological support techniques will help.

# XII. Managing the Patient Who Has Dyspnea

Time: 15 minutes

Slides: 70–78

Lecture

**A. Overview**

1. The paramedic has a short list of tools to treat respiratory compromise.
    a. Supportive care, high-concentration supplemental oxygen therapy, and monitoring and transporting patients
2. The primary exception is treatment of bronchoconstriction.
    a. Bronchodilators are available.
3. In respiratory failure, the primary approach is to take over the work of breathing completely by intubation and ventilation.

**B. Ensure an adequate airway.**

1. Get rid of any food, gum, chewing tobacco, or like items.
2. Suction if necessary.

**C. Decrease the work of breathing.**

1. Remove constricting clothing or other miscellaneous causes of stress.

**D. Provide supplemental oxygen.**

1. If the patient is breathing adequately, administer 100% oxygen via a breathing mask.
2. Patients who are not breathing adequately should receive bag-mask ventilation and 100% oxygen.

**E. Bronchodilate.**

1. Aerosol bronchodilators rarely hurt; they are used aggressively in the field now.

**F. Consider fluid balance.**

1. Rehydration is supplemental therapy for patients with respiratory problems who are dehydrated.

**G. Provide diuresis.**

1. Many have a component of congestive heart failure and could benefit from a loop diuretic.

**H. Support/assist ventilation.**

1. Therapy with CPAP and BiPAP
2. Bag-mask ventilation

 

### I. Take over ventilation.

1. Intubation and ventilation in respiratory failure
   a. Intubation should be the last option for patients with severe asthma.
   b. Be proactive; ventilate patients before cardiac arrest occurs.
   c. Patients who have had a stroke or who are severely intoxicated may have little or no gag reflex (dangerous if they vomit).
   d. Some patients who have diabetes or have overdosed present with an obvious need for intubation; if an ampule of 50% dextrose or naloxone is likely to completely change the situation, it might be better to use bag-mask ventilation for initial therapy.

# XIII. Respiratory Pharmacology

| |
|---|
| Time: 15 minutes |
| Slides: 79–88 |
| Lecture |

### A. Medication Delivery

1. Metered-dose inhalers
   a. Should deliver the same amount of medication as an aerosol treatment
   b. Drawbacks include the necessity for a cooperative patient able to perform the maneuver correctly, and the possibility of an empty inhaler.
   c. Spacers: devices that collect the medication as it is released from the canister, allowing more to be delivered to the lungs and less to be lost to the environment
   d. Mist isn't a breath freshener; patients need to deeply inhale, not swallow.
   e. Patients mistakenly blow into the spacer.
   f. Spacers make a harmonica-like sound if the patient sucks too hard.
   g. Inhale and hold for a few seconds.
   h. Giving the bronchodilator first makes the medication more effective.
   i. After using a corticosteroid inhaler, patients are encouraged to rinse out their mouth with water or mouthwash.
   j. Make sure the inhaler contains medication.
   k. Keep the spacer and canister holder clean.
2. Aerosol therapy
   a. Nebulizers deliver liquid medications in the form of a fine mist.
   b. In the home, most people run their aerosol treatments off of a small air compressor.
   c. In the ambulance, tanked oxygen or a wall unit attached to main oxygen supply
   d. The nebulizer can be attached to a mouthpiece (pipe), a face mask, a tracheostomy collar, or simply held in front of the patient's face.
   e. Significant humidity
3. Dry powder inhalers
   a. Some medications are stable in a very fine powder.
   b. Convenient and easy to use
   c. Rarely used in emergency care

 

   d. Common corticosteroids and slow-acting bronchodilators packaged in a disc-like device holding about 1 month's medication
   e. Other devices include a capsule pierced and inhaled.
4. Subcutaneous injections
   a. Inhalation may be unreliable or ineffective.
   b. Subcutaneous terbutaline or epinephrine
5. Direct instillation
   a. Administration via the endotracheal tube
6. Fast-acting bronchodilators
   a. Rescue inhalers provide almost instant relief.
7. Anticholinergics
   a. Block parasympathetic response
   b. In the past, atropine through aerosol
   c. Today, ipratropium specifically designed for aerosol use
8. Slow-acting bronchodilators
   a. Do not provide immediate relief of symptoms
   b. If taken daily they can reduce the frequency and severity of asthma attacks.
   c. Dramatically improve the quality of life for many patients who have respiratory illness
9. Leukotriene modifiers
   a. Bronchoconstricting chemical (leukotrienes) released during an allergic response
   b. Patients benefit from a leukotriene blocker.
10. Methylxanthines
   a. Once the mainstay of asthma and COPD therapy
   b. Popularity has declined because of their adverse effects (cardiac)
11. Electrolytes
   a. In very serious asthma attacks, some physicians give 0.5 to 2 g of magnesium sulfate intravenously.
12. Corticosteroids
   a. Reduce bronchial swelling
   b. Inhaled corticosteroids: appear to not have the same adverse effects as their oral counterparts; common adjuncts to the treatment of asthma and COPD
   c. IV corticosteroids: a single bolus of IV does not appear to cause any negative long-term consequences.
13. Expectorants
   a. Thin secretions so they can be coughed out
   b. Avoid antihistamines.
14. Antitussives
   a. Designed to stop a cough
15. Diuretics
   a. Used to help reduce blood pressure and maintain fluid balance

 

b. Loop diuretics are the most commonly used in emergency situations.

16. Vasodilators
    a. Morphine dilates the vascular bed, reducing cardiac preload and allowing fluid to leave the lungs and return to the bloodstream.
    b. Also reduces pain and anxiety

# XIV. Assisted Ventilation

Time: 5 minutes

Slides: 89–91

Lecture

## A. Continuous Positive Airway Pressure (CPAP)

1. People with sleep apnea wear a CPAP unit at night to maintain their airways while they sleep.
    a. Applied via nasal pillows, a nasal mask, or a face mask
    b. This prevents obstruction of the upper airway when the person sleeps (hypoxic episodes and snoring).
2. Therapy for respiratory failure
    a. Face mask delivery (good seal with minimal leakage)
    b. 100% supplemental oxygen driving gas for positive pressure
    c. Administering CPAP increases pressure in the chest.

## B. Bilevel Positive Airway Pressure (BiPAP)

1. CPAP with IPAP and EPAP
    a. One pressure during inspiration (inspiratory positive airway pressure) and a different pressure during exhalation (expiratory positive airway pressure)
    b. Often more comfortable for the patient

## C. Automated Transport Ventilators

1. Flow-restricted oxygen-powered ventilation devices with timers
    a. Set to deliver a particular volume at a particular rate

## D. You are the Provider Summary

Slide: 92

Discussion

1. Continue presenting the case study provided on the slide:
    a. Respiratory calls are quite common.
    b. You should be able to immediately recognize and differentiate among the many different types of acute respiratory distress to which you are called to respond.

## E. Summary

1. Anatomy
2. Physiology

 

3. Respiratory disease
4. Principles of management

## Post-Lecture

# I. Prep Kit Activities

Time: 65 minutes

*Note: This section contains various student-centered end-of-chapter activities designed as enhancement to instructor's preparation. As time permits, these activities may be presented in class. They are also designed to be used as outside homework/activities.*

### A. Assessment in Action

Time: 20 minutes

Individual/Small Group Activity/Discussion

#### Purpose

This activity is designed to assist students in gaining a further understanding of the chapter content. This activity allows students an opportunity to analyze an emergency care scenario, develop responses, and integrate what they have learned.

#### Instructor Directions

1. Direct students to read the "Assessment in Action" scenario located in the Prep Kit at the end of Chapter 26.
2. Direct students to read and individually answer the quiz questions at the end of the scenario. Facilitate a class review and dialogue of the answers, allowing students to correct responses as may be needed. Use the quiz question answers noted below to assist in building this review.
3. You may also wish to assign these as individual activities and ask students to turn in their comments on a separate piece of paper.

#### Answers to Multiple-Choice Questions

*You arrive on the scene and find a 63-year-old woman in moderate respiratory distress. She is in the tripod position, using some accessory muscles, and is speaking in three- to four-word sentences. The patient is conscious, alert, and orientated to person, place, and time. Her blood pressure is 134/70 mm Hg; her heart rate is 118 beats/min and regular; and her respiratory rate is 28 breaths/min. The pulse oximeter reads 90%. The patient's skin is warm and her nail beds are slightly cyanotic. She has been taking her albuterol inhaler all day and it hasn't worked. She states this all began 2 days ago and has not gotten any better. She is wheezing in all lung fields.*

1. Which of the following is essential for normal ventilations to occur?
   A. Functional diaphragm and intercostal muscles
   B. Interstitial space that is not filled with fluid

 

C. Adequate blood volume
D. Pulmonary capillaries that are not occluded

**Answer: A.** Adequate blood volume and open pulmonary capillaries are related to perfusion. Normal interstitial space affects diffusion.

2. What is chronic obstructive pulmonary disease?

A. A recurring condition of partially reversible airflow obstruction
B. An acute inflammation of the lungs
C. An absence of breath sounds on one side
D. A progressive and irreversible disease of the airway

**Answer: D.** COPD is a progressive and irreversible disease of the airway and is seen by a decreased inspiratory and expiratory capacity of the lungs. It can result from chronic bronchitis or emphysema.

3. What might bring about an exacerbation in an underlying respiratory condition?

A. Stress and infections
B. Cigarette smoking
C. Exercising
D. All of the above

**Answer: D.** All of the above will cause an exacerbation of underlying respiratory conditions. Stress plays a significant role, especially in adults. Infections, especially upper respiratory infections, can exacerbate a respiratory condition. Cigarette smoking increases the chances of getting COPD. Exercising may exacerbate any preexisting respiratory condition.

4. What are important questions to ask this patient?

A. Has this happened before?
B. Have you ever been intubated in the past?
C. Is breathing uncomfortable when you lie down (more comfortable when you are sitting up or standing)?
D. All of the above

**Answer: D.** All of the above are very important to ask this patient. It is important to know whether this patient has been intubated in the past because this will tell you how severe this patient's distress can get. Remember not to use medical terminology when talking with patients. For example, answer C is asking whether the patient has orthopnea, but is phrased in nonmedical terminology. This will prevent confusion and help you get the correct answer. Using the OPQRST mnemonic is very helpful. Also, when you arrive, first ask why the patient called.

5. What is usually the most reliable indicator of the patient's severity of respiratory distress?

A. One-word sentences
B. Gross diaphoresis and pale color

 

C. Patient's description of respiratory distress
D. Tachycardia

**Answer: C.** Though all of the above are signs of respiratory distress, in patients with chronic respiratory sickness, their reported level of distress is the best indication of the severity of their current condition. If patients are calling for an ambulance, there is something wrong.

6. What are wheezes?

A. High-pitched, whistling sounds
B. Noises heard on auscultation of lungs, caused by popping open of air spaces
C. Absent breath sounds
D. Bubbling sounds heard at the bases of the lungs

**Answer: A.** Wheezes are high-pitched, whistling sounds made by air being forced through narrowed airways, which makes them vibrate. Wheezing may be diffuse in conditions such as asthma or congestive heart failure, or may be localized when caused by a foreign body obstructing a bronchus.

7. What is emphysema?

A. Reversible narrowing of the airways
B. Chronic weakening and destruction of the walls of the terminal bronchioles and alveoli
C. An acute inflammatory condition of the lungs
D. The leading cause of respiratory illnesses in children

**Answer: B.** Emphysema is a chronic weakening and destruction of the walls of the terminal bronchioles and alveoli. It is characterized by a barrel chest, muscle wasting, and pursed-lip breathing. Patients who have emphysema are more often tachypneic than not.

8. What is the hypoxic drive?

A. To not move adequate volumes of gas
B. A respiratory pattern characterized by ketoacidosis
C. A situation in which a person's stimulus to breathe comes from a fall in arterial $P_{O_2}$ rather than the normal stimulus, a rise in arterial $P_{CO_2}$
D. The portion of tidal volume that does not reach the alveoli

**Answer: C.** Hypoxic drive is a situation in which a person's stimulus to breathe comes from a fall in arterial $P_{O_2}$ rather than the normal stimulus, a rise in arterial $P_{CO_2}$. It is rare and affects only a small percentage of patients who have COPD. In these patients, the primary stimulus to breathe comes from decreased levels of oxygen, not increased levels of carbon dioxide as in patients who do not have COPD.

9. You should withhold oxygen from a patient who has been diagnosed with COPD.

A. True
B. False

 

**Answer: B.** False. You should never withhold oxygen from a patient in respiratory distress. A patient who has COPD needs oxygen. Hypoxic drive is a rare phenomenon that affects only a small percentage of patients who have COPD.

10. What is peak expiratory flow?

    A. Maximum flow rate at which patients can expel air from their lungs
    B. Partial obstruction of the upper airway by the tongue
    C. Adventitious breath sounds when auscultating the lungs
    D. Silent lung fields

**Answer: A.** Peak expiratory flow is the maximum flow rate at which patients can expel air from their lungs. Many patients with respiratory illness will check their own peak flows several times a day. The results may vary from person to person. Normal peak flow values vary by age, sex, and height, but it is safe to say that peak flow below 150 L/min is very low and should alert you to significant distress.

### Challenging Questions

*You are dispatched to the train station. Arriving on the scene, you find a 54-year-old man in respiratory distress. Upon auscultation of his lungs, you note wheezing in all lung fields. The patient is unable to talk to you.*

11. Is this patient having an asthma attack?

**Rationale:** Not necessarily. Do not assume an asthma attack. All that wheezes is not asthma. Wheezing may be present in other respiratory disorders that cause dyspnea, such as COPD, left heart failure, pulmonary embolism, pneumothorax, and foreign body aspiration. Perform a complete physical examination and try to obtain a complete history. Only through these two methods will you be able to reach the correct diagnosis. It is very important to distinguish between the wheezing of asthma and the wheezing of left heart failure because their treatment modalities are completely different.

## B. Points to Ponder

| |
|---|
| Time: 20 minutes |
| Individual/Small Group Activity/Discussion |

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

### Purpose

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

### Instructor Directions

1. Direct students to read the "Points to Ponder" scenario found in the Prep Kit at the end of Chapter 26.

 

2. You may wish to assign students to a partner or a group and direct them to review the discussion question at the end of the scenario and prepare a response. Facilitate a class dialogue centered on the discussion point.
3. You may also ask students to complete this activity on their own and hand in their comments on a separate piece of paper.
4. Personally review the scenario and discussion question based on your experience and knowledge as an emergency care worker. Develop your own key points for guiding this discussion.

**Scenario**

*Your shift is just beginning and you are dispatched to the home of a 90-year-old man who has respiratory problems. It's a cold winter evening and the BLS crew is about ready to bring him to the ambulance. You enter the house and immediately hear audible crackles coming from the next room. The crew has the patient on 100% oxygen via nonrebreathing mask. The patient is conscious, alert, and orientated to person, place, and time. Blood pressure is 220/110 mm Hg, respiratory rate is 40 breaths/min, heart rate is 85 beats/min, and pulse oximetry is 91%. The patient has jugular venous distention and peripheral edema.*

*The patient appears to be in severe respiratory distress, using accessory muscles, speaking in one-word sentences, and grossly diaphoretic. Family states that this all began while he was watching TV approximately 45 minutes ago, and has gotten progressively worse. The patient's medications include metoprolol (Toprol), pravastatin (Pravachol), furosemide (Lasix), potassium, and digoxin. The family cannot tell you much about his medical history.*

*What do you know about this patient, based on his presentation and medications?*

**Issues**

Recognizing a Respiratory Emergency, Timely and Correct Treatment, Determining Medical History Based on Medications.

**Discussion**

The ability to immediately recognize a patient in respiratory distress is paramount to properly treating patients. Understanding components of the respiratory system and how it all works is invaluable to you as a paramedic. You must be able to appropriately question a patient and/or his or her family. Normally, asking open-ended questions is the preferred way to question a patient. The OPQRST mnemonic is very helpful in this line of questioning. However, because the patient is in severe respiratory distress, asking yes-or-no questions would be appropriate. It is important to ask the patient or family the following questions: When did the respiratory distress start? Has this ever happened before? Is the patient more comfortable sitting up? Does he have any other symptoms such as chest pain? The physical exam is very important. Note the patient's positioning and degree of distress. Based on how this patient presents, you should have been able to give a field differential diagnosis of congestive heart failure. Knowing local protocol regarding treatment of patients in respiratory distress is important. Each state has

 

standing orders related to various medical emergencies. Learning local protocols is vital. With proper treatment, the chances of this patient's condition improving before you arrive at the emergency department are maximized.

As the paramedic, you will encounter family members who are unsure of their loved one's medical problems. Or there may be no one home but the patient. If the patient is in severe distress, as this scenario implies, the patient may be unable to communicate his or her medical history. You should be able to look at the medications the patient is taking and surmise the patient's medical history. For example, this patient takes digoxin, furosemide, and potassium. This should automatically clue you in to a history of congestive heart failure. Digoxin is an antiarrhythmic, furosemide (Lasix) is a diuretic, and potassium is for electrolyte replacement. Metoprolol (Toprol) is a beta blocker. What is important to recognize here is that the patient's heart rate is 85 beats/min. When a patient is taking a beta blocker, their resting heart rate could be as low as 55 to 65 beats/min. You should consider this patient tachycardic. This reading is 20 beats/min over what is normal. A patient's medications will tell you a lot about his or her medical history. Knowing the medications people take is very important in being able to piece things together. Recognizing what those medications do is also important. You should also ask patients whether or not they took their medications today.

# II. Lesson Review

Time: 10 minutes

Discussion

*Note: Facilitate the review of this lesson's major topics using the review questions as direct questions or overhead transparencies. Answers are found throughout this lesson plan. Each question includes a reference to the slide where the information is covered.*

1. How does inhalation occur? (Lecture II-B)
2. What are the characteristics of Cheyne-Stokes breathing? (Lecture II-B)
3. What is the significance of chocolate brown skin? (Lecture IV-A)
4. What questions should be asked in the present history component of the focused history? (Lecture IV-B)
5. What important physical exam elements should be assessed in a patient with a respiratory emergency? (Lecture IV-C)
6. What are the characteristics of vesicular breath sounds? (Lecture IV-D)
7. How is croup differentiated from epiglottitis? (Lecture V-B)
8. How is asthma differentiated from COPD? (Lecture VI-B)
9. Why are steroids used in the treatment of some respiratory disorders? (Lecture XIII-A)

# III. Assignments

Time: 5 minutes

 

Lecture

1. Review all materials from this lesson and be prepared for a lesson quiz to be administered (date to be determined by instructor).
2. Read Chapter 27: *Cardiovascular Emergencies* for the next class session.

 