Chapter 24
Respiratory

Lesson 24.1
Pathophysiology and Assessment
Learning Objectives

• Distinguish the pathophysiology of respiratory emergencies related to ventilation, diffusion, and perfusion.
• Outline the assessment process for the patient who has a respiratory emergency.

Respiratory Anatomy

• Structures divided into upper, lower airways
  — Location assigned in relation to glottic opening
    • Upper is above
    • Lower is below
Respiratory Anatomy

• Upper airway structures
  – Nasopharynx
  – Oropharynx
  – Laryngopharynx
  – Larynx

Respiratory Anatomy

• Lower airway structures
  – Trachea
  – Bronchial tree
  – Alveoli
  – Lungs

Physiology

• Pulmonary respiration
  – For gas exchange to occur, air must move freely in and out of lungs
  – Brings oxygen to lungs and removes CO₂
• Exchange of gases between cells of body and outside environment
Pulmonary Respiration

• Made possible by
  – External respiration
    • Transfer of O₂ and CO₂ between inspired air and pulmonary capillaries
  – Internal respiration
    • Transfer of O₂ and CO₂ between capillary red blood cells and tissue cells

Pulmonary Respiration

• Factors
  – Structure and function of chest wall
    • Diaphragm
    • Ribs
    • Intercostal muscles
    • Accessory muscles

Pulmonary Respiration

• Factors
  – Control of respirations by CNS
    • Medulla
    • Phrenic nerve innervation of diaphragm
    • Spinal nerves that innervate intercostal muscles
    • Reflexes that prevent overinflation
  – Acid-base balance mediated by buffer systems
Pathophysiology

- Gas exchange
  - Provides for cellular needs, excretion of wastes
- Specific disorders related to respiratory emergencies related to
  - Ventilation
  - Diffusion
  - Perfusion

Pathophysiology

- Intrinsic
  - Asthma
  - Obstructive lung disease
  - Cancer
  - Pulmonary edema
  - Pulmonary emboli
  - Stress
- Extrinsic
  - Prevalence of COPD and cancer
  - Severity of respiratory disorders

Ventilation

- Process of air movement into and out of lungs
  - For ventilation to occur, following must be intact
    - Neurological control (to initiate ventilation)
    - Nerves between brain stem and muscles of respiration
    - Functional diaphragm and intercostal muscles
    - Patent upper airway
    - Functional lower airway
    - Alveoli that are functional and have not collapsed
Ventilation

- Pathophysologies associated with ventilation
  - Upper and lower airway obstruction
  - Chest wall impairment
  - Problems in neurological control
- Emergency treatments
  - Open and clear airways
  - Provide assisted ventilations

Diffusion

- Process of gas exchange
  - Occurs between air filled alveoli and pulmonary capillary bed
  - Driven by simple diffusion
    - Gases move from areas of high concentration to low concentration
    - Occurs until concentrations are equal

- Intact requirements
  - Alveolar, capillary walls not thickened
  - Interstitial space between alveoli and capillary wall not enlarged or filled with fluid
Diffusion

- Pathophysiologies
  - Inadequate O₂ concentration in ambient air
  - Alveolar disorders
  - Interstitial space disorders
  - Capillary bed disorders
- Emergency treatment
  - Provide high-concentration O₂
  - Must reduce inflammation in interstitial space

Perfusion

- Circulation of blood through lung tissues
- Intact requirements
  - Adequate blood volume
  - Adequate hemoglobin in the blood
  - Pulmonary capillaries that are not occluded
  - Efficient pumping by heart provides a smooth flow of blood through pulmonary capillary bed

- Pathophysiologies
  - Inadequate blood volume/hemoglobin levels
    - Hypovolemia
    - Anemia
  - Impaired circulatory blood flow
    - Pulmonary embolus
    - Capillary wall disorders
**Unknown Pulmonary Diagnosis**

- If unknown diagnosis, try to determine whether it is primarily related to
  - Ventilation
  - Diffusion
  - Perfusion
  - Combination of defects

- Care should be focused on specific disorder responsible for respiratory emergency

**Unknown Pulmonary Diagnosis**

- Ventilation disorders managed with assisting patient’s airway by mechanical means
  - Opening airway
  - Relieving airway obstructions
  - Clearing airway of secretions
  - Use of airway adjuncts

**Unknown Pulmonary Diagnosis**

- Diffusion disorders treated to improve gas exchange between alveoli and pulmonary capillary bed
  - Medications to improve breathing and reduce inflammation in airways
  - CPAP
Unknown Pulmonary Diagnosis

- Perfusion disorders managed by improving circulation of blood through lung tissues
  - Medications to improve cardiac function
- All patients with respiratory compromise should receive high-concentration O₂ and ventilatory support as needed

Primary Survey

- General impression
- Detect/manage life-threatening conditions that affect airway, breathing, circulation
- Resuscitation, primary survey take priority over detailed assessment

Primary Survey

- Life-threatening respiratory distress signs
  - Alterations in mental status
  - Severe cyanosis
  - Audible stridor
  - Inability to speak one or two words without dyspnea
  - Tachycardia (greater than 130 bpm)
  - Pallor and diaphoresis
  - Retractions and/or the use of accessory muscles to assist breathing
Primary Survey

• Quick assessment of lung sounds
  – Absent/diminished breath sounds
  – Crackles
  – Wheezes
  – Rhonci

Focused History

• Obtain patient’s chief complaint
  – Dyspnea
  – Chest pain
  – Productive or nonproductive cough
  – Hemoptysis (coughing up blood from respiratory tract)
  – Wheezing
  – Signs of respiratory infection

Focused History

• Should focus on patient’s previous experiences with similar or identical symptoms
  – Patient’s objective description of severity often is accurate indicator of severity
  – Ask patient: “What happened the last time you had an attack this severe?”
    • Useful for predicting what will happen this episode
Focused History

• Use OPQRST
  – Onset
    • What were you doing when the breathing difficulty began?
    • Do you think anything might have triggered it?
    • Did your breathing difficulty begin gradually or was it sudden in onset?
    • Did you experience any pain when the breathing difficulty began?

• OPQRST
  – Provocation
    • Does lying down or sitting up make your breathing better or worse?
    • Do you have any pain when you breath?
    • If so, does the pain increase when you take a deep breath or does it stay the same?
  – Quality
    • Is it more difficult to breathe when you inhale or exhale?
    • If you have pain when you breathe, would you describe it as sharp or dull?

• OPQRST
  – Severity
    • On a scale of 0 to 10 (with 10 being the worst), how would you rate the difficulty of your breathing?
  – Time
    • What time did the breathing difficulty start?
    • Has it been constant since it began?
    • If you’ve had this type of difficulty before, how long did it last?
Focused History

• Medication history
  – Current medications
  – Medication allergies
  – Cardiac medications
  – Pulmonary medications
    • In-home O₂ therapy
    • Inhaled, oral, or parenteral sympathomimetics
    • Inhaled or oral corticosteroids
    • Cromolyn sodium
    • Methylxanthines
    • Antibiotics

Secondary Assessment

• Should be guided by
  – Paramedic’s general impression of patient
  – Patient’s chief complaint
  – Note patient’s position, mental status, ability to speak, respiratory effort, and skin color

Secondary Assessment

• Vital sign assessment
  – Pulse rate
    • Tachycardia may be sign of hypoxemia
    • Bradycardia caused by respiratory problems is warning sign of severe hypoxemia and imminent cardiac arrest
Secondary Assessment

• Vital sign assessment
  – Blood pressure
    • Hypertension may result from use of medications patient takes to manage cardiac and respiratory disorders
    • Hypertension also may result from patient's fear and anxiety
    • Hypotension can be caused by medication therapy
    • May also result from fluid loss and dehydration in some respiratory illnesses

Secondary Assessment

• Vital sign assessment
  – Respiratory rate
    • Not accurate sign of respiratory status unless very slow
    • Trends are essential in evaluating patient with chronic respiratory disease
    • Slowing rate in patient who is not improving suggests exhaustion and impending respiratory insufficiency
    • Abnormal patterns that may be seen in patients with severe illness or injury include tachypnea, Cheyne-Stokes respirations, central neurogenic hyperventilation, Kussmaul respirations, ataxic respirations, apneustic respirations, and apnea

Secondary Assessment

• Vital sign assessment
  – Respiratory rate
  – Abnormal patterns seen in patients with severe illness or injury
    • Tachypnea
    • Cheyne-Stokes respirations
    • Central neurogenic hyperventilation
    • Kussmaul respirations
    • Ataxic respirations
    • Apneustic respirations
    • Apnea
Secondary Assessment

- Assess patient’s face and neck for
  - Pursed-lip breathing
  - Grunting
  - Nasal flaring
  - Use of accessory muscles
    - Visible head bobbing in infants indicates they are using accessory muscles to breathe
    - Pursed-lip breathing and grunting helps maintain pressure in airways (even during exhalation)
    - Pressure helps to support bronchial walls internally that have lost their external support as a result of disease

Secondary Assessment

- Accessory muscle use
  - Can quickly result in respiratory fatigue
- Patient’s neck should be evaluated for jugular vein distention
  - Jugular vein distention may be sign of right-sided heart failure resulting from severe pulmonary congestion

Secondary Assessment

- Question about sputum production
  - Increasing amount of sputum suggests infection
  - Thick, green, or brown sputum may indicate pneumonia
  - Yellow or pale gray sputum may be related to allergic or inflammatory causes
  - Pink, frothy sputum is associated with severe and late stages of pulmonary edema
Secondary Assessment

• Chest examination
  – Inspect for injury, if indicated by history
  – Inspect for any indicators of chronic disease
  – Note accessory muscle use or retractions to facilitate breathing
  – Evaluate chest wall symmetry
  – Auscultate patient’s lungs for normal and abnormal breath sounds

Secondary Assessment

• Extremities should be assessed for
  – Peripheral cyanosis
  – Pitting edema
  – Clubbing of fingers
  – Carpopedal spasm
• Peripheral cyanosis is caused when large amount of hemoglobin in blood is not carrying O₂

Secondary Assessment

• Pitting edema is indication of heart failure
• Clubbing is abnormal enlargement of ends of fingers
  – Indicates long-standing chronic hypoxemia
• Carpopedal spasms are spasms of hands, thumbs, feet, or toes
  – Often associated with hypcapnia that results from hyperventilation
Secondary Assessment

- Physical findings in patient with respiratory disease should be documented on PCR
  - Should be communicated to medical direction

Diagnostic Testing

- For some patients with respiratory disease
  - Oximetry
  - Capnometry
  - Use of peak flow meters
  - Pulse oximeters measure O₂ saturation
  - Capnography monitors end-tidal CO₂
  - Peak flow meters provide baseline assessment of airflow for patients with obstructive lung disease
Diagnostic Testing

• Helps determine how well patient is being oxygenated
• Measures transmission of red and near-infrared light through arterial beds using probe placed on a finger, toe, or earlobe
  – Hemoglobin bound with O₂ (oxyhemoglobin) absorbs more infrared than red light
  – Reduced hemoglobin absorbs more red than infrared light
  – Pulse oximeter measures this difference and calculates the O₂ saturation of blood (SaO₂)

Pulse Oximetry

• Low range of normal SaO₂ is 93 to 95 percent
• Upper range is 99 to 100 percent
  – SaO₂ below 90 percent indicates PaO₂ of 60 mm Hg or less
• SaO₂ of 75 percent indicates PaO₂ of 40 mm Hg
• SaO₂ of 50 percent indicates a PaO₂ of 27 mm Hg

Capnography

• Noninvasive monitoring technique primarily used in prehospital setting to confirm correct tracheal tube placement
  – When used in conjunction with pulse oximetry and ECG monitoring, can provide insight into ventilation, circulation, and metabolism
  – Useful indicator of efficient CPR and also can help confirm diagnosis of pulmonary embolism
Capnography

- Noninvasive monitoring technique primarily used in prehospital setting to confirm correct tracheal tube placement
  - In patients with hemorrhage, capnography can provide
    • Continuous hemodynamic monitoring
    • Information about tissue perfusion
    • Fluid resuscitation strategies for patients in shock

Capnography

- Graphical representation of CO₂ concentration exhaled through breath
  - Measurements are taken by capnography filter attached to facemask or nasal canula or endotracheal tube
  - Graphic representation is displayed as waveform (measured in millimeters of mercury) on capnogram throughout respiratory cycle
    • Capnometer displays only numerical value of PaCO₂, not waveform

Capnography

- Each waveform on the capnogram consists four phases
  - Phase 1 (A–B) represents air exhaled from conducting airways with low level of CO₂
  - Phase 2 (B–C) represents mixture of air from anatomical dead space and alveolar gas
    • CO₂ begins to rise
  - Phase 3 (C–D) represents plateau as alveolar gas is exhaled (alveolar plateau)
  - Phase 4 (D–E) represents inspiration (inspiration washout) where D is end tidal volume (peak concentration) and E is sharp decline in CO₂ concentration
Capnography

- Waveform helps to detect any rebreathing of CO₂
  - Useful in diagnosing problems associated with increased dead space

Capnography

- Ventilation-perfusion mismatch
  - Can be caused by blood shunting as seen with atelectasis
  - Can be caused by dead space in lungs such as occurs with pulmonary embolism
  - All result in continuous increase in CO₂
  - Waveform that plateaus late in expiration phase can indicate heart failure, COPD, and pulmonary embolus
Peak Flow Meters

• Used in pulmonary function tests to measure patient’s peak expiratory flow rate (PEFR)
  – PEFR is measurement of how fast person can exhale air
  – Tests used to help determine severity of asthma attack
  – Can help assess effectiveness of treatment of respiratory disease in prehospital setting
  – Requires cooperative patient who can make maximal respiratory effort
  – Requires coaching by paramedic

Peak Flow Meters

• To determine baseline airflow (before drug administration)
  – Instruct patient to inflate lungs fully and forcefully exhale as quickly as possible into flow meter
  – Children should be reminded to breathe out as if they were blowing out candles or blowing up balloon
  – Reading is recorded in liters/minute
  – Measurement should be taken two more times
Peak Flow Meters

- Highest of three readings is chosen as peak value flow
  - Measurement is then compared with standard tables based on height, gender, and race
  - PEFR measurement with variability less than 20 percent is considered mild
  - 20 to 30 percent is moderate
  - More than 30 percent is severe
  - Measurements should be repeated throughout course of management to evaluate patient’s response to drug therapy

Lesson 24.2
Respiratory Disorders and Diseases
Learning Objectives

• Describe the causes, complications, signs and symptoms, and prehospital management of patients diagnosed with obstructive airway disease, pneumonia, adult respiratory distress syndrome, pulmonary thromboembolism, upper respiratory infection, spontaneous pneumothorax, hyperventilation syndrome, and lung cancer.

Obstructive Airway Disease

• Major health problem
  – Affects some 32 million people in United States
• Predisposing factors
  – Smoking
  – Environmental pollution
  – Industrial exposures
  – Various pulmonary infectious processes

Obstructive Airway Disease

• Triad of distinct diseases that often coexist
  – Chronic bronchitis and emphysema (together referred to as chronic obstructive pulmonary disease [COPD])
  – Asthma
Chronic Bronchitis

- Condition involving inflammatory changes and excessive mucus production in bronchial tree
- Preventable
  - Fourth leading cause of death in United States

Chronic Bronchitis

- Characterized by an increase in the number and size of mucus-producing glands
  - Results from prolonged exposure to irritants
  - Diagnosed clinically by presence of cough with sputum production that is present half the time for at least two consecutive years
  - Alveoli are not seriously affected and diffusion remains relatively normal
Chronic Bronchitis

- Patients with severe chronic bronchitis have low oxygen pressure (Po2) because of changes in ventilation–perfusion relationships in lung and hypoventilation
  - Sometimes called “blue bloaters” because of their hypoxia and fluid retention

Chronic Bronchitis

- Hypoventilation leads to
  - Hypercapnia (high levels of CO2)
  - Hypoxemia (low levels of O2)
  - Increases in Pco2

Chronic Bronchitis

- Patients with frequent respiratory infections
  - Eventually cause scarring of lung tissue
  - In time, irreversible changes occur in lung
  - May lead to emphysema or bronchiectasis
    - Bronchiectasis is abnormal dilation of bronchi
    - Caused by pus-producing infection of bronchial wall
Emphysema

- Results from pathological changes in lung
  - End stage of process that progresses slowly for many years

Emphysema

- Characterized by
  - Permanent abnormal normal enlargement of air spaces beyond terminal bronchioles
  - Destruction and collapse of alveoli
  - Reduces number of alveoli available for gas exchange
  - Reduces elasticity of remaining alveoli
  - Leads to trapping of air in alveoli
  - Residual volume increases, vital capacity remains relatively normal
Emphysema

• Reduction in arterial Po2 leads to increased production of red blood cells and polycythemia (an elevated hematocrit value)
  – Elevation in hematocrit much more common in chronic bronchitis than in primary emphysema
  • Chronic bronchitis is more often chronically hypoxemic
  • Decreases in alveolar membrane surface area and in number of pulmonary capillaries in lung reduce area for gas exchange
  • Responsible an increase resistance to pulmonary blood flow

Emphysema

• Shows some resistance to airflow into and out of lungs
  – Most hyperexpansion is caused by air trapping secondary due loss of elastic recoil
  • Chronic bronchitis results in increased airway resistance during inspiration and expiration
  – In contrast, patients with emphysema have increased airway resistance only on expiration
  – Normally passive, involuntary act, expiration becomes muscular act in patients with COPD
Emphysema

• Over time, chest becomes barrel shaped from trapping of air
  – Must use accessory muscles of neck, chest, and abdomen to move air into and out of lungs
  – Full deflation of lungs becomes more and more difficult
  – Becomes impossible
  – Often patient with emphysema is thin because of poor dietary intake and increased caloric consumption required by work of breathing

Emphysema

• Patients often develop bullae (thin-walled cystic lesions in lung) from destruction of alveolar walls
  – Blebs (collection of air within visceral pleura) also may develop
    • When bullae collapse or blebs rupture, increase diffusion defect
    • Can lead to pneumothorax

COPD Assessment

• Patients with COPD usually aware of and have adapted to illness
  – Request for emergency care indicates that significant change has occurred in patient’s condition
  – Patient with COPD usually has
    • Acute episode of worsening dyspnea that is manifested even at rest
    • Increase or change in sputum production
    • Increase in malaise that accompanies disease
    • Inability to sleep and recurrent headaches
Will patients with COPD always be able to “name” their disease when you ask about their history?

COPD Assessment

• On EMS arrival, will likely be in respiratory distress
  – Often sitting upright and leaning forward to aid in breathing
  – Frequently using pursed-lip breathing to maintain positive airway pressures
  – Using accessory muscles

COPD Assessment

• On EMS arrival, will likely be in respiratory distress
  – Increased hypoxemia and hypercarbia indicated by
    • Tachypnea
    • Diaphoresis
    • Cyanosis
    • Confusion
    • Irritability
    • Drowsiness
What effect might application of a cervical collar, short spine board or vest, and immobilization on a long backboard have on a patient with COPD who has sustained trauma?

COPD Assessment

• Other physical findings
  – Wheezes
  – Rhonchi
  – Crackles
  – Diminished breath and heart
    • Due to reduced air exchange and increased diameter of thoracic cavity

COPD Assessment

• Other physical findings
  – In late stages of decompensation, may have
    • Peripheral cyanosis
    • Clubbing of fingers
    • Signs of right-sided heart failure
  – ECG may reveal cardiac dysrhythmias or signs of right atrial enlargement
    • Include tall, peaked P waves in leads II, III, and AVF
  – Called "pink puffers" because of red face they make during forced exhalation
COPD Management

• Primary goal is correction of hypoxemia through improved airflow
  – Can be achieved through administration of O₂ and drug therapy
  – Drug therapy may cause serious side effects and complications, especially if patient has used medication before EMS arrival
    • Crucial to obtain thorough medical history regarding medication use, home oxygen use, and drug allergies

COPD Management

• Establish IV line in all patients in respiratory distress
• Apply cardiac monitor
• If patient has productive cough, coughing should be encouraged
  – Any sputum should be collected and delivered with patient for laboratory analysis

COPD Management

• Some patients rely on hypoxic drive for ventilatory effort
  – Never withhold O₂ because of fear of decreasing hypoxic drive while providing emergency care inprehospital setting
  – High-concentration O₂ should be administered with nonrebreather mask if indicated
  – Pulse oximetry to measure O₂ saturation is indicated
COPD Management

- Some will require ventilatory assistance
  - Breathing may require augmentation with CPAP or BiPAP
  - CPAP
    - Improves oxygenation
    - Reduces work of breathing
    - Prevents atelectasis
    - Allows for drug administration
  - Positive pressure ventilation
    - May prevent need for intubation and risks and complications associated with invasive airway procedures

COPD Management

- Prehospital medications used for bronchospasm and to reduce constricted airways are beta agonists
  - Levalbuterol
  - Albuterol
- Other drugs given for bronchodilation and stimulation of the respiratory drive after evaluation by a physician
  - Steroids (methylprednisolone)
  - Nebulized anticholinergics (ipratropium)
Asthma

- Asthma, or reactive airway disease
  - Common disorder that affects nearly 23 million Americans, including 7 million children
  - Responsible for 4,000 to 5,000 deaths each year
  - Most common in children and young adults
  - Can occur in any decade of life

- Asthma, or reactive airway disease
  - Exacerbating factors tend to be extrinsic (external) in children
  - Exacerbating factors tend to be intrinsic (internal) in adults
  - Childhood asthma often improves or resolves with age
  - Adult asthma usually is persistent
Asthma

• Generally occurs in acute episodes of variable duration
  – Between these episodes, patient is relatively free of symptoms
  – Attack is characterized by reversible airflow obstruction caused by
    • Bronchial smooth muscle contraction
    • Hypersecretion of mucus, resulting in bronchial plugging
    • Inflammatory changes in bronchial walls

Asthma

• Increased resistance to airflow leads to
  – Alveolar hypoventilation
  – Marked ventilation–perfusion mismatching (leading to hypoxemia)
  – CO₂ retention (stimulating hyperventilation)
• Obstruction of inspiration and marked obstruction of expiration causes pressure to remain high in airways, as result of air trapping in lungs
Asthma

- During acute asthma attack, combination of increased airway resistance, increased respiratory drive, and air trapping creates excessive demand on the muscles of respiration
  - Leads to greater use of accessory muscles
  - Increases chance of respiratory fatigue
  - If labored breathing continues, high pressures in thorax can reduce amount of blood returning to left ventricle (left ventricular preload)

Asthma

- Left ventricle preload
  - Result is drop in cardiac output and systolic BP (near-fatal asthma)
  - Pulsus paradoxus may be seen
  - If episode continues, hypoxemia and changes in blood flow and BP may lead to death
  - Most asthma-related deaths occur outside hospital

Asthma

- In prehospital setting, cardiac arrest in patients with severe asthma has been linked to
  - Severe bronchospasm and mucous plugging, which leads to asphyxia (most common cause of asthma-related deaths)
  - Cardiac dysrhythmias caused by hypoxia
  - Tension pneumothorax (often bilateral)
Asthma

- Other conditions that may be present in patients with near-fatal asthma
  - Cardiac disease
  - Pulmonary disease
  - Acute allergic bronchospasm or anaphylaxis
  - Drug use or misuse (beta blockers, cocaine, and opiates)
  - Recent discontinuation of long-term corticosteroid therapy (associated with adrenal insufficiency)

Asthma Assessment

- Asthmatic patient usually is sitting upright
  - May be leaning forward with hands on knees (tripod position) and using accessory muscles to aid breathing
- Typically in obvious respiratory distress
  - Respiration are rapid and loud
  - Audible wheezing may be present

Asthma Assessment

- Note and monitor patient’s mental status
  - Impending respiratory failure signs
    - Lethargy
    - Exhauston
    - Agitation
    - Confusion
Asthma Assessment

• Note and monitor patient’s mental status
  – Initial history must be obtained quickly
    • Onset of current episode
    • Relative severity
    • Precipitating cause
    • Medication use
    • Allergies
    • Crucial to know if patient has needed intubation to manage his or her previous asthma

Asthma Assessment

• On auscultation, prolonged expiratory phase may be noted
  – Wheezing is heard from movement of air through narrowed airways
    • Inspiratory wheezing (unlike inspiratory stridor) does not indicate upper airway occlusion
    • Suggests that large and midsize muscular airways are obstructed
    • Indicates more obstruction than if only expiratory wheezes are heard

Asthma Assessment

• On auscultation, prolonged expiratory phase may be noted
  – Wheezing is heard from movement of air through narrowed airways
    • Inspiratory wheezes also may suggest that large airways are filled with secretions
    • Silent chest (i.e., no audible wheezing or air movement) may indicate such severe obstruction that flow of air is too low to generate breath sounds
Asthma Assessment

- Other signs of severe asthma
  - Reduced level of consciousness
  - Diaphoresis and pallor
  - Retractions
  - Inability to speak after only one or two words
  - Poor, floppy muscle tone
  - Pulse rate > 130 bpm
  - Respirations > 30 bpm
  - Pulsus paradoxus > 20 mm Hg
  - Altered mental status or severe agitation
  - End-tidal CO₂ > 45 mm Hg

Asthma Management

- After administration of high-concentration O₂, drug therapy is provided
  - Drug therapy is based on patient’s age and medication use before EMS arrival
  - Nebulized albuterol is current cornerstone of asthma treatment in United States
    - Fast-acting beta2 agonist stimulates beta-adrenergic receptors and acts as rapid bronchodilator
    - Side effects include transient tachycardia and tremor
    - Other nebulized drugs used to manage asthma include levalbuterol, ipratropium, or combination of albuterol and ipratropium

- If patient is unable to tolerate nebulized medications, SQ, IM, or IV drug therapy will likely be indicated to treat bronchoconstriction
  - Epinephrine and terbutaline
  - CPAP or BiPAP can be beneficial in managing reactive airway disease
    - Should only be considered if patient is alert and has adequate spontaneous respirations
Asthma Management

• IV fluids may be indicated for rehydration
• Transport in position of comfort
  – Maximizes use of respiratory muscles
• Monitor for cardiac rhythm disturbances

Asthma Management

• In rare cases, advanced airway management is required for patient having severe asthma attack
  – Absolute indications for immediate intubation of wheezing patient are apnea and coma
  – Intubation should be considered if
    • \( P_O_2 < 50 \) mm Hg with (supplemental oxygen)
    • \( P_C_O_2 > 50 \) mm Hg (with acute respiratory acidosis)
    • \( P_C_O_2 \) is increasing, despite maximal therapy
    • Patent is fatigued
    • Mental status is depressed

Asthma Management

• Rapid sequence intubation
  – If conscious, consult with medical direction and consider following critical actions
    • Provide adequate sedation with ketamine or etomidate
    • Paralyze patient with succinylcholine or vecuronium (if credentialed or authorized in your state)
    • Immediately after intubation, administer 2.5 to 5 mg albuterol directly into ET tube
Asthma Management

• Rapid sequence intubation
  – If conscious, consult with medical direction and consider following critical actions
    • Confirm ET tube placement with primary and secondary confirmation methods
    • Ventilate at 6 to 10 bpm and smaller tidal volumes (6 to 8 mL/kg)
    • Deliver breaths with shorter inspiratory time, and prolong the expiratory time to allow for escape of air and to avoid sudden hypotension (especially in elderly patients with emphysema)

Status Asthmaticus

• Severe, prolonged asthma attack not broken with repeated doses of bronchodilators
  – May be of sudden onset, resulting from spasm of airways
  – Can also be subtle onset, resulting from viral respiratory infection or prolonged exposure to one or more allergens
  – True emergency
    • Early recognition
    • Rapid transport
    • Danger of respiratory failure

When a patient being managed for status asthmaticus is reassessed, would decreasing respiratory and heart rates indicated a good or bad outcome? Why?
Status Asthmaticus

- Treatment is same as that for acute asthma attacks
  - Urgency of rapid transport is more important
  - Patients usually are dehydrated
    - Typically require IV fluid administration
  - Monitor respiratory status closely
  - Administer high-concentration O₂
  - Need for intubation and aggressive ventilatory support should be anticipated
  - Continuous bronchodilator therapy with nebulized and parenteral drugs may be indicated

What options do you have to promote bronchodilation if the patient is unable to hold the nebulizer mouthpiece or needs to be ventilated using a bag device?

Differential Considerations

- Wheezing commonly associated with asthma
  - May be present in all types of diseases that cause dyspnea
    - Appropriate emergency care based on patient assessment and accurate history
Lesson 24.3
Pneumonia, ARDS, URI, and Lung Cancer

Learning Objective
• Describe the causes, complications, signs and symptoms, andprehospital management of patients diagnosed with obstructive airway disease, pneumonia, adult respiratory distress syndrome, pulmonary thromboembolism, upper respiratory infection, spontaneous pneumothorax, hyperventilation syndrome, and lung cancer.

Pneumonia
• Group of specific infections (not single disease) that cause acute inflammatory process of respiratory bronchioles and alveoli
• Kills more than 60,000 Americans each year
  – Leading cause of death in children worldwide
• Can be caused by bacterial, viral, or fungal infection
Pneumonia

- Associated risk factors
  - Cigarette smoking
  - Alcoholism
  - Exposure to cold
  - Extremes of age (very young and very old)
- May be spread by
  - Respiratory droplets through contact with infected individuals
  - Breathing in bacteria from one's own nose and mouth

Pneumonia

- Classified as viral, bacterial, mycoplasmal, or aspiration type
- Manifests with classic signs and symptoms (typical pneumonia)
  - Productive cough
  - Pleuritic chest pain
  - Fever that produces “shaking chills” (usually associated with bacterial infection)
  - May cause nonspecific complaints
  - Nonspecific complaints may include nonproductive cough, headache, fatigue, and sore throat (atypical pneumonia)
Viral Pneumonia

- Influenza A is most common type of viral pneumonia
  - Often occurs as epidemics in populations of small groups such as schoolchildren, army recruits, and nursing home residents
  - Infection caused by virus predisposes patient to secondary bacterial pneumonia

Bacterial Pneumonia

- Until 2000, pneumococcus bacillus (Streptococcus pneumoniae) accounted for 90 percent of bacterial pneumonias
  - It affected 1 in 500 people each year
  - Decline in cases is related to vaccination of infants against pneumococcus bacteria
  - Peak incidence is in winter and early spring
  - Vaccine now available is effective against this type of pneumonia in adults

Bacterial Pneumonia

- Can result from aspiration of mucus and saliva
  - Patients in a coma or with seizures, suppressed cough reflex, and increased secretions are predisposed to developing disease
Bacterial Pneumonia

• Other predisposing risk factors
  – immune status infection
  – Upper respiratory infection (influenza)
  – Postoperative infection
  – Foreign body aspiration
  – Alcohol or other drug addiction
  – Cardiac failure
  – Stroke
  – Syncope

Bacterial Pneumonia

• Other predisposing risk factors
  – Pulmonary embolism
  – Chronic illness
  – Chronic respiratory disease
  – Diabetes mellitus
  – Congestive heart failure
  – Prolonged immobilization
  – Compromised immune status

Mycoplasmal Pneumonia

• Caused by infection with mycoplasma pneumoniae
  – Causes mild upper respiratory infection in school-age children and young adults
  – Transmission occurs by means of infected respiratory secretions
    • Spreads quickly among family members
  – Can be treated effectively with antibiotics

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Aspiration Pneumonia

• Inflammation of lung tissue (parenchyma)
  – Results when foreign material enters tracheobronchial tree
  – Common in patients who
    • Have altered level of consciousness
    • Are intubated
    • Have aspirated foreign bodies

Aspiration Pneumonia

• Factors
  – Depression of cough or gag reflex
  – Inability to handle secretions or gastric contents
  – Inability to protect airway

Aspiration Pneumonia

• May be nonbacterial
  – May develop after aspiration of stomach contents, toxic materials, or inert substances
  – Called pneumonitis to distinguish it from infectious pneumonia or bacterial pneumonia (as a secondary complication)
  – Bacterial aspiration pneumonia has poor prognosis, even with antibiotic therapy
Pneumonia Management

• Pathophysiology depends on agent that caused disease
  – In viral and mycoplasmal pneumonias, inflammatory response in bronchi damages cilia and epithelium
  • Causes congestion
  • In some cases, causes hemorrhage

Pneumonia Management

• Signs and symptoms
  – Chest pain
  – Cough
  – Fever
  – Dyspnea
  – Occasionally hemoptysis

Pneumonia Management

• Complaint
  – General malaise
  – Upper respiratory and GI
• Auscultation of chest may reveal wheezing and fine crackles
  – In uncomplicated cases, symptoms usually resolve in 7 to 10 days
Pneumonia Management

• Bacterial pneumonia begins with infection in alveoli
  – In time, infection fills alveoli with fluid and purulent sputum
  – Spreads from alveolus to alveolus
  – As this occurs, large areas of lung, even entire lobes, may become consolidated (filled with fluid and cellular debris)
    • Reduces available surface area of respiratory membranes
    • Decreases ventilation-perfusion ratio
    • Both effects may lead to hypoxemia

Pneumonia Management

• Bacterial pneumonia symptoms
  – Acute shaking chills
  – Tachypnea
  – Tachycardia
  – Cough
  – Sputum production
    • May be rust colored (classic for pneumococcus)
    • More often yellow, green, or gray

Pneumonia Management

• Bacterial pneumonia symptoms
  – Malaise
  – Anorexia
  – Flank or back pain
  – Vomiting
  – If uncomplicated and treated with antibiotics, patient begins to recover within 3 to 5 days
  – Antibiotics usually continued for total of 7 to 10 days
Pneumonia Management

• Aspiration pneumonia physiological effects
  – Based on volume and pH of aspirated substances
  – If pH is less than 2.5 (as may occur in aspiration of stomach contents), possible occurrences
    • Atelectasis
    • Pulmonary edema
    • Hemorrhage
    • Cell necrosis
    • Alveolar-capillary membrane may be damaged, which may lead to accumulation of fluid in alveoli
    • In severe cases, may lead to adult respiratory distress syndrome

Pneumonia Management

• Signs and symptoms vary with scenario and severity of insult
  – Possible clinical features
    • Dyspnea
    • Cough
    • Bronchospasm
    • Wheezes
    • Rhonchi
    • Crackles
    • Cyanosis
    • Pulmonary and cardiac insufficiency
  • Good percentage develops pulmonary infection

Pneumonia Management

• Prehospital care
  – Airway support
  – O₂ administration
  – Ventilatory assistance as needed
  – IV fluids to support BP and thin and loosen mucus
  – Cardiac monitoring
  – Transport
  – Bronchodilator drugs may be used for some patients
  – In aspiration, suctioning of airway may be required
What measures can the paramedic take to minimize the patient’s risk of aspiration?

Pneumonia Management

- General patient management
  - Bed rest
  - Analgesics
  - Decongestants
  - Expectorants
  - Antipyretics
  - Antibiotic therapy
- In severe cases
  - Bronchoscopy
  - Intubation
  - Mechanical ventilation may be required for some patients

Acute Respiratory Distress Syndrome

- Acute respiratory distress syndrome (ARDS) is a fulminant form of respiratory failure
  - Characterized by acute lung inflammation and diffuse alveolar-capillary injury
  - All disorders that result in ARDS cause severe noncardiogenic pulmonary edema
Acute Respiratory Distress Syndrome

• ARDS is fulminant form of respiratory failure
  – Syndrome develops as complication of injury or illness such as
    • Trauma
    • Gastric aspiration
    • Cardiopulmonary bypass surgery
    • Gram-negative sepsis
    • Multiple blood transfusions
    • O₂ toxicity
    • Toxic inhalation
    • Drug overdose
    • Pneumonia
    • Infections

• Regardless of cause, increased capillary permeability (high-permeability noncardiogenic pulmonary edema) results in clinical condition
  – Lungs are wet and heavy, congested, hemorrhagic, and stiff
  – Decreased perfusion capacity across alveolar membranes
  – Lungs become noncompliant
    • Requires patient to increase pressure in airways to breathe
Acute Respiratory Distress Syndrome

- Pulmonary edema associated with ARDS leads to
  - Severe hypoxemia
  - Intrapulmonary shunting
  - Reduced lung compliance
  - In some cases, irreversible damage to lung tissue
- Most patients have healthy lungs before event that caused disease, no history of recent respiratory illness or disease

Acute Respiratory Distress Syndrome

- More common in men than women
- Affects about 190,000 people in U.S. each year
- Mortality rate is over 65 percent

Acute Respiratory Distress Syndrome

- Complications
  - Respiratory failure
  - Cardiac dysrhythmias
  - Disseminated intravascular coagulation
  - Barotrauma
  - Congestive heart failure
  - Renal failure
ARDS Management

• Prehospital management
  – High-concentration O₂ and ventilatory support
  – Fluid replacement to maintain cardiac output and peripheral perfusion
  – Drug therapy to support mechanical ventilation
  – Pharmacological agents (e.g., corticosteroids) to stabilize pulmonary, capillary, alveolar walls
  – Diuretics

ARDS Management

• Symptoms
  – Tachypnea
  – Labored breathing
  – Impaired gas exchange 12 to 72 hours after initial injury or medical crisis
• Often results from another illness or injury
  – Consider cause of underlying problem
  – Provide supplemental O₂ and ventilatory support to improve arterial oxygenation (assessed by pulse oximetry)

ARDS Management

• Most patients with moderate to severe respiratory distress require mechanical ventilation
  – Includes use of positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP)
    • Both provide positive-pressure ventilation
Pulmonary Embolism

- Blockage of pulmonary artery
  - Blocked by clot or other foreign material that has traveled there from another part of body
  - Usually originate in the lower extremities
  - Relatively common disorder
    - Affects about 650,000 people each year in United States
    - 30 to 50 percent die
    - 10 percent die within first few hours after blockage
    - Severe pulmonary embolism, where shock and heart failure occur, death more than 50 percent
    - Responsible for 5 percent of all sudden deaths

Pulmonary Embolism

- Usually begins as venous disease
  - Most often caused by migration of thrombus from large veins of lower extremities
  - Also can occur as result of fat, air, sheared venous catheters, amniotic fluid, or tumor tissue
    - Clot or embolus dislodges and travels through venous system to right side of heart
    - Then migrates to pulmonary arteries, obstructing blood supply to section of lung
    - Most common sites of thrombus formation are deep veins of legs and pelvis
Pulmonary Embolism

- Venous thrombosis factors
  - Venostasis
    - Extended travel
    - Prolonged bed rest
    - Obesity
    - Advanced age
    - Burns
    - Varicose veins
  - Venous injury
    - Surgery of thorax, abdomen, pelvis, legs
    - Fractures of pelvis or legs

- Venous thrombosis factors
  - Increased blood coagulability
    - Malignancy
    - Use of oral contraceptives
    - Congenital or acquired coagulation disorders
    - Pregnancy
  - Multiple trauma
    - Long bone fracture
    - Pelvic fracture

- Venous thrombosis factors
  - Disease
    - Chronic lung disease with polycythemia
    - Congestive heart failure
    - Sickle cell anemia
    - Cancer
    - Atrial fibrillation
    - MI
    - Previous pulmonary embolism
    - Previous deep vein thrombosis
    - Infection
    - Diabetes mellitus
What information in the patient assessment may help distinguish PE from other conditions that can cause similar signs and symptoms?

Pulmonary Embolism

• Blocked pulmonary arteries
  – Area does not receive blood flow
  – Vasoconstriction occurs
  – Continues to be ventilated
  – If vascular obstruction is severe (blockage of 60 percent or more), possible complications
    • Hypoxemia
    • Acute pulmonary hypertension
    • Systemic hypotension
    • Shock may rapidly occur, with subsequent death

Pulmonary Embolism

• Signs and symptoms
  – Embolus may be small, moderate, or massive
  – Depend on location and size of clot
  – Dyspnea
  – Cough
  – Hemoptysis (rare)
  – Pain
  – Anxiety
  – Syncope
Pulmonary Embolism

• Signs and symptoms
  – Hypotension
  – Diaphoresis
  – Tachypnea
  – Tachycardia
  – Fever
  – Distended neck veins
  – Chest splinting
  – Pleuritic pain
  – Pleural friction rub
  – Crackles
  – Localized wheezing

• If embolism is large, sudden cardiac arrest can occur
  – Consider PE in any patient who has cardiorespiratory problems that cannot be otherwise explained, particularly when risk factors are present
  – Continuous capnometry may be useful in identifying PE

PE Management

• Prehospital care
  – Mainly is supportive
    • Supplemental high-concentration O₂
    • Cardiac monitor and pulse oximeter applied
    • IV line of normal saline or lactated Ringer’s solution
    • Transport in position of comfort

• Definitive care
  – Requires hospitalization and in-hospital treatment with fibrinolytic or heparin therapy
Upper Respiratory Infection

- Affect nose, throat, sinuses, larynx
- Among most common of all illnesses, affecting nearly 80 million people each year

Upper Respiratory Infection

- Illnesses include
  - Common cold
  - Pharyngitis
  - Tonsillitis
  - Sinusitis
  - Laryngitis
  - Croup
- Rarely life-threatening

Upper Respiratory Infection

- Often exacerbate underlying pulmonary conditions
  - May lead to significant infections in patients with suppressed immune function
- Prevention for spread of respiratory infections
  - Hand washing
  - Covering mouth when sneezing or coughing
  - Variety of bacteria and viruses can cause upper respiratory infections (URIs)
Upper Respiratory Infection (URI)

• Signs and symptoms
  – Sore throat
  – Fever
  – Chills
  – Headache
  – Facial pain (sinusitis)
  – Purulent nasal drainage
  – Halitosis (bad breath)
  – Cervical adenopathy (enlarged cervical lymph nodes)
  – Erythematous pharynx (pharyngeal inflammation/irritation)

URI Management

• Most are self-limiting and require little or no prehospital treatment
  – Aimed at relieving symptoms
• Patients with underlying lung conditions
  – O₂ administration
  – Bronchodilators or corticosteroids administration
  – If throat cultures obtained at scene, family must be notified of the results
  – Follow-up by physician is required
  – Follow local protocol

When can a URI become life-threatening? Think of two or three examples.
Spontaneous Pneumothorax

• Usually results when bleb ruptures
  – Allows air to enter pleural space from within lung
  – May occur in seemingly healthy individuals who are usually 20 to 40 years of age
  – Patients are tall, thin men with long, narrow chests
  – May develop from underlying disease, such as COPD

Spontaneous Pneumothorax

• In recent years occurrence has increased in some populations
  – AIDS
  – Pneumonia
  – Drug abusers who deeply inhale free-base cocaine, marijuana, or inhalants (e.g., glue or solvents)
  – Consider patient with COPD, especially if patient has been treated with positive-pressure ventilation

Spontaneous Pneumothorax

• Most that are well tolerated by patient occupy less than 20 percent of a lung (partial pneumothorax)
• Signs and symptoms
  – Shortness of breath
  – Chest pain that often is sudden in onset
  – Pallor
  – Diaphoresis
  – Tachypnea
Spontaneous Pneumothorax

• Severe cases in which pneumothorax occupies more than 20 percent of hemithorax, signs and symptoms
  – Altered mental status
  – Cyanosis
  – Tachycardia
  – Decreased breath sounds on the affected side
  – Local hyperresonance to percussion
  – Subcutaneous emphysema

Spontaneous Pneumothorax

• Management
  – Prehospital care
    • Based on patient’s symptoms and degree of respiratory distress
    • High-concentration O₂
    • Airway, ventilatory, and circulatory support
    • Transported in position of comfort

Spontaneous Pneumothorax

• Management
  – Definitive care
    • Decompression of pleural space
    • Surgery
    • Allows for lung reexpansion or to prevent recurrence
    • Chest decompression for tension pneumothorax
Hyperventilation Syndrome

• Abnormally deep or rapid breathing that results in excessive loss of CO₂
  – Produces respiratory alkalosis
• Syndrome produces hypocarbia
  – Leads to
  ▪ Cerebrovascular constriction
  ▪ Reduced cerebral perfusion
  ▪ Paresthesia
  ▪ Dizziness
  ▪ Feelings of euphoria

How can you distinguish between hyperventilation caused by anxiety versus a serious medical illness or toxic ingestion?

Hyperventilation Syndrome

• Causes
  – Anxiety
  – Hypoxia
  – Pulmonary disease
  – Cardiovascular disorders
  – Metabolic disorders
  – Neurological disorders
  – Fever
  – Infection
  – Pain
  – Pregnancy
  – Drug use
Hyperventilation Syndrome

• Signs and symptoms
  – Dyspnea with rapid breathing and high minute volume
  – Chest pain
  – Facial tingling
  – Carpopedal spasm
  – Low ET CO₂ measurement is common

Management

• If caused by anxiety (psychogenic dyspnea, which is diagnosis of exclusion), prehospital care is mainly supportive
  – Calming measures and reassurance
  – O₂ administration
  – Airway and ventilatory support
  – Paramedic should be calm and coach patient’s ventilations
  – If severe or complicated by illness or drug ingestion, transport for evaluation indicated

Lung Cancer

• Epidemic in U.S.
  – Estimated 219,000 new cases reported each year
  – Most cases of lung cancer develop in individuals 55 to 65 years of age
  – Of new cases reported, most patients die of disease within 1 year
    • 20 percent have local lung involvement
    • 25 percent have spread to lymph system
    • 55 percent have distant metastatic cancer
Lung Cancer

• Most common cause is cigarette smoking
  – Heavy smokers (more than 20 cigarettes a day) have 25 times greater chance of developing lung cancer than nonsmokers
• Other risk factors
  – Passive smoking (exposure to someone else’s cigarette smoke)
  – Exposure to asbestos, radon gas, dust, coal products, ionizing radiation, other toxins

Lung Cancer

• Uncontrolled growth of abnormal cells
  – At least 12 different cell types of tumors are associated with primary lung cancer
  – Two major cell types
    • Small cell lung cancer
    • Non-small cell lung cancer: squamous cell carcinoma, adenocarcinoma, and large cell carcinoma
  – Each has different growth pattern
  – Each has different response to treatment
  – Most abnormal cell growth begins in bronchi or bronchioles
  – Lung also is fairly common site of metastasis (spread of cancer) to other primary sites
Lung Cancer

• Signs and symptoms of early-stage disease often are nonspecific
  – Smokers often attribute them to effects of smoking
    • Coughing
    • Sputum production
    • Lower airway obstruction (noted by wheezing)
    • Respiratory illness (e.g., bronchitis)

Lung Cancer

• Signs and symptoms of early-stage disease often are nonspecific
  – As disease progresses, signs and symptoms
    • Cough
    • Hemoptysis (which may be severe)
    • Dyspnea
    • Hoarseness or voice change
    • Dysphagia
    • Weight loss/anorexia
    • Weakness

Lung Cancer

• Cancer patients may call paramedics because of complications resulting from chemotherapy or radiation therapy
  – Toxic to both normal body cells and malignant cells
  – Associated complaints
    • Nausea and vomiting
    • Fatigue
    • Dehydration
  – Offer emotional and psychological support
Lung Cancer Management

• Prehospital management
  – Airway, ventilatory, and circulatory support
  – O₂ administration (based on symptoms and pulse oximetry)
  – Transport
  – Possible IV fluids may be needed to improve hydration and to thin sputum
  – Drug therapy (e.g., bronchodilators and corticosteroids)
  – Analgesics

Lung Cancer Management

• Most patients with lung cancer are aware of their disease
• End-stage patients may have advance directives or “do not resuscitate” (DNR) orders
  – Offer emotional support to family and loved ones

Should you assume that a DNR status is desired by patients with lung cancer?
Summary

• Diseases responsible for respiratory emergencies include those related to ventilation, diffusion, and perfusion
  – Ventilation moves air into and out of lungs
  – Diffusion is process of gas exchange
  – Perfusion is circulation of blood through tissues

Summary

• Patients should be assessed for chief complaint, signs and symptoms of respiratory distress, and past medical history
  – Physical examination should determine vital signs, indicators of increased work of breathing, breath sounds, and peripheral edema or cyanosis
  – Capnometry, oximetry, and peak flow measurements supplement physical examination findings

Summary

• Obstructive airway disease is triad of distinct diseases that often coexist
  – These are chronic bronchitis, emphysema, and asthma
  – Main goal of prehospital care for these patients is correction of hypoxemia through improved air flow
• Chronic bronchitis is characterized by inflammatory changes and excessive mucus production in alveoli
  – These patients often have low blood O2 levels and excess CO2 levels
Summary

• Emphysema causes abnormal enlargement of air spaces beyond terminal bronchioles and destruction and collapse of alveoli

Summary

• Asthma, or reactive airway disease, is characterized by reversible airflow obstruction caused by bronchial smooth muscle contraction; hypersecretion of mucus, resulting in bronchial plugging; and inflammatory changes in the bronchial walls
  – Typical patient with asthma is in obvious distress
  – Respirations are rapid and loud
  – Treatment focuses on bronchodilation, hydration, and reducing inflammation

Summary

• Pneumonia is group of specific infections (bacterial, viral, or fungal)
  – Infections cause acute inflammatory process of respiratory bronchioles and alveoli
  – Pneumonia usually manifests with classic signs and symptoms
    • Include productive cough and associated fever that produces “shaking chills”
    • Prehospital care of patients with pneumonia includes airway support, oxygen administration, ventilatory assistance as needed, IV fluids, cardiac monitoring, and transport
Summary

• Acute respiratory distress syndrome (ARDS) is a fulminant form of respiratory failure
  – Characterized by acute lung inflammation and diffuse alveolar-capillary injury
  – Develops as complication of illness or injury
  – In ARDS, lungs are wet and heavy, congested, hemorrhagic, and stiff, with decreased perfusion capacity across alveolar membranes and includes airway and ventilatory support

Summary

• Positive end-expiratory pressure maintains pressure at end of exhalation
  – Adding PEEP in respiratory circuit keeps alveoli open and pushes fluid from alveoli back in interstitium or capillaries
  – Continuous positive airway pressure maintains constant airway pressure throughout entire respiratory cycle
  – CPAP improves diffusion and helps re-expand collapsed alveoli
  – Biphasic positive airway pressure delivers variable airway pressure throughout respiratory cycle

Summary

• Pulmonary thromboembolism is blockage of pulmonary artery by clot or other foreign material
  – When one or more pulmonary arteries is blocked by an embolism, section of lung is ventilated but hypoperfused
  – Hypotension, shock, and death can occur
  – Prehospital care is mainly supportive and includes O₂ administration, IV access, and transport for definitive care
Summary

- Upper respiratory infections affect nose, throat, sinuses, and larynx
  - Signs and symptoms include sore throat, fever, chills, headache, cervical adenopathy, and erythematous pharynx
  - Prehospital care is based on patient’s symptoms

Summary

- Primary spontaneous pneumothorax usually results when subpleural bleb ruptures
  - Allows air to enter pleural space from within lung
  - Signs and symptoms include shortness of breath and chest pain that often are sudden in onset, pallor, diaphoresis, and tachypnea
  - Prehospital care is based on patient’s symptoms and degree of distress

Summary

- Hyperventilation syndrome is abnormally deep or rapid breathing
  - Results in excessive loss of CO₂
  - If syndrome clearly is caused by anxiety, prehospital care is mainly supportive (i.e., calming measures and reassurance)
  - Paramedic may suspect syndrome is result of illness or drug ingestion
    - If so, care may include O₂ administration and airway and ventilatory support
Summary

• Lung cancer is expression of uncontrolled growth of abnormal cells
  – As disease progresses, signs and symptoms may include cough, hemoptysis, dyspnea, hoarseness, and dysphagia
  – Prehospital management includes airway, ventilatory, and circulatory support

Questions?