Chapter 21
Pulmonary

Learning Objectives
• Explain the importance of the respiratory tract and the prevalence of pulmonary disease
• Explain the basic role of pulmonary diagnostic testing in medical care
• Identify the anatomy of the upper airway

Learning Objectives (Cont'd)
• Describe the etiology, epidemiology, history, physical findings; develop a treatment plan for upper respiratory tract infection, epiglottitis, croup, bacterial tracheitis, peritonsillar abscess
• Describe the etiology, epidemiology, history, physical findings; develop a treatment plan for upper airway obstruction, trauma, tracheostomy
Learning Objectives (Cont’d)
• Describe the etiology, epidemiology, history, physical findings; develop a treatment plan for disorders of pleura, mediastinum, lung, chest wall: costochondritis, pleurisy, pneumomediastinum, pneumothorax, pleural effusion, noncardiogenic pulmonary edema, acute respiratory distress syndrome
• Identify the anatomy of the lower airway

Learning Objectives (Cont’d)
• Describe the etiology, epidemiology, history, and physical findings; develop a treatment plan for asthma, bronchiolitis, bronchopulmonary dysplasia, chronic obstructive pulmonary disease, cystic fibrosis, pneumonia, lung abscess, pulmonary thromboembolism, hyperventilation syndrome, atelectasis, tumors

Learning Objectives (Cont’d)
• Describe the etiology, epidemiology, history, and physical findings; develop a treatment plan for pulmonary infection such as pneumonia, tuberculosis, aspiration
• Describe the etiology, epidemiology, history, and physical findings; develop a treatment plan for environmental, occupational exposure to inhaled agents/irritants, gases, fumes, vapors
Introduction

- Respiratory tract
  - Gaseous exchange for body
  - Expels waste, balance blood, body chemistry
- Patient airway
- Diseases of the respiratory tract
  - Upper airway
  - Lower airway

Approach to the Patient

- Primary assessment
  - Respiratory distress indicators
    - Mental status change
    - Dyspnea at rest
    - Severe cyanosis
    - Absent breath sounds
    - Audible stridor
  - Difficulty speaking
  - Tachycardia
  - Pallor, diaphoresis
  - Retractions
  - Accessory muscle use

Approach to the Patient (Cont’d)

- History
  - Chief complaint
  - Onset time, activities at onset
  - Prior episodes, diagnoses
  - Past treatments, medical history
  - Medication and compliance
  - Allergies
Approach to the Patient (Cont’d)

- History
  - Assessment
    - Infection signs
    - Cough, productive/nonproductive, color sputum

Approach to the Patient (Cont’d)

- Physical examination
  - Patient position can provide clues
  - Mental status

Approach to the Patient (Cont’d)

- Physical examination
  - Respiratory compromise indicators
    - Inability to complete sentences
    - Accessory muscle use
    - Pursed lips on exhalation
    - Exaggerated chest movement with minimal air movement, tracheal tugging
    - Cyanosis, pallor, diaphoresis
Approach to the Patient (Cont’d)

- Physical examination
  - Vital signs
    - Tachycardia, respiratory distress
    - Bradycardia, severe hypoxia, imminent cardiac arrest
    - Blood pressure, unchanged in respiratory distress
    - Respiratory rate, quality, pattern
    - Extremities

Approach to the Patient (Cont’d)

- Diagnostic testing
  - Pulse oximetry
  - Peak flow meters

Approach to the Patient (Cont’d)

- Diagnostic testing
  - Capnography
    - Phase I
      - Beginning of exhalation when air from anatomic dead space is being exhaled
      - Baseline
Approach to the Patient (Cont’d)

• Diagnostic testing
  ➢ Capnography
    ➢ Phase II
      ➢ CO₂ from larger bronchi begins to pass sensor
      ➢ Expiratory upslope
      ➢ Sharp increase in CO₂ concentration passing sensor, rapid departure of waveform from baseline
      ➢ Rapidly departs from Phase I, vertical line

Approach to the Patient (Cont’d)

• Diagnostic testing
  ➢ Capnography
    ➢ Phase III
      ➢ Alveolar plateau
      ➢ CO₂-rich alveolar air passing sensor
      ➢ Flat, straight/slightly angled upward

Approach to the Patient (Cont’d)

• Diagnostic testing
  ➢ Capnography
    ➢ Phase 0
      ➢ End of exhalation, beginning of inhalation
      ➢ CO₂ levels passing sensor quickly drop to 0
      ➢ Quick return of waveform to baseline
      ➢ Straight line, rapidly returns to baseline
Approach to the Patient (Cont’d)

Normal Capnogram

- Diagnostic testing
  - Capnography
    - Changes in any phase when the respiratory system is impaired
    - Vertical axis, amount of CO₂ exhaled
    - Horizontal axis, time of exhalation
    - Junction of Phase II and III, 90° angle
    - Repetitive, consistent alterations investigated
    - Expiratory phase prolongation, phase III lengthened

- Shark fin waveform
- ETCO₂ determines if bronchoconstriction is acute or chronic
- Phase 0 abnormalities, inhalation problems
- Decreased CO₂
**Upper Airway**

- Anatomy of the upper airway
  - Nasopharynx
  - Oropharynx
  - Humidity, clean air entering the lower respiratory tract
  - Mucus secreted in sinuses, nasopharynx, oropharynx

**Upper Airway (Cont’d)**

- Assessment
  - Ensure airway patency
  - Quality, frequency of respirations
  - Minute volume
Upper Airway (Cont’d)

- Assessment
  - Oropharynx
    - Check for obstruction
    - Assess mucous membranes, tongue for hydration
    - Assess aspiration potential

Upper Airway (Cont’d)

- Assessment of upper airway
  - Retractions
    - Examine neck, spaces above clavicles
    - Accessory muscle use
    - Palpate trachea for deviation
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Upper respiratory tract infection
    - Infection of any structures
      - Sinusitis
      - Pharyngitis
      - Laryngitis
      - Tonsillitis

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Upper respiratory tract infection
    - History and physical findings
      - Headache
      - Nasal congestion
      - Nasal drainage
      - Nasal inflammation
      - Sore throat
      - Cough
      - Mucus production with cough
      - Fever
      - Chills
      - Muscle aches
      - Once infected, lifelong immunity to virus

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Upper respiratory tract infection
    - Differential diagnosis
      - May precede serious infection
      - Meningitis
      - Sinusitis
      - Pneumonia
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Upper respiratory tract infection
    - Therapeutic interventions
      - Supportive
      - Position of comfort
      - O₂
      - Pulse oximeter
      - Oxygen saturation >95%
      - Respiratory distress signs, IV, cardiac monitor, capnography

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Epiglottis
    - Potentially life-threatening infection of airway supraglottic structures
    - Inflammation on tongue base, aryepiglottic folds, arytenoids, tonsils, epiglottis
Upper Airway (Cont’d)

• Acute upper airway disorders
  ➢ Epiglottis
    • Edema, trachea, supraglottic areas
    • Airway narrowing, closure

Upper Airway (Cont’d)

• Acute upper airway disorders
  ➢ Epiglottis
    • History and physical findings, adults
      ➢ URI precedes
      ➢ Difficulty swallowing
      ➢ Painful swallowing
      ➢ Sore throat
      ➢ Muffled voice tachycardia
      ➢ Pain on palpation of anterior neck
      ➢ Sniffing position

Upper Airway (Cont’d)

• Acute upper airway disorders
  ➢ Epiglottis
    • History and physical findings, children
      ➢ Acute
      ➢ High fever
      ➢ Anxious
      ➢ Sniffing position
      ➢ Breathing difficulty
      ➢ Stridor
      ➢ Voice absence
      ➢ Drooling
      ➢ Difficulty swallowing
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Epiglottis
    - Therapeutic interventions
    - Supplemental O₂
    - Rapid transport
    - Must recognize the diagnosis, notify the hospital
    - Airway equipment nearby for impending respiratory failure

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Croup
    - Upper airway infection
    - Just below the glottis
    - Swollen, inflamed mucosa

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Croup
    - “Seal bark” cough, 3-4 days
    - Hoarse, inspiratory stridor
    - No difficulty swallowing, drooling
    - Low-grade fever
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Croup
    - Minor croup
      - Minimal distress
      - Normal mental status
      - Well hydrated
      - Stridor when agitated
      - Cough intermittent
      - Mild tachycardia
      - Mild tachycardia

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Croup
    - Moderate croup
      - Alert, interactive, irritable
      - Stridor
      - Classic cough
      - Tachypnea
      - Tachycardia
      - Retractions

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Croup
    - Severe croup
      - Respiratory failure, complete obstruction risk
      - Fatigue
      - Altered mental status
      - Hypoxia, hypercarbia
      - Severe respiratory distress
      - Stridor
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Croup
    - Therapeutic interventions
      - Patient calm, comfortable, position of comfort
      - Humidified O₂, pulse oximeter
      - Oxygen saturation >95%
      - Nebulized saline, epinephrine
      - Transport
      - Respiratory failure/arrest, bag-mask with 100% O₂

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Bacterial tracheitis
    - Bacterial infection of the trachea

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Bacterial tracheitis
    - History and physical findings
      - Fever
      - Chills
      - Inspiratory stridor
      - Barking, brassy cough
      - Hoarseness
      - Degree of dyspnea
      - Absent drooling
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Bacterial tracheitis
    - Therapeutic interventions
      - Antibiotics
      - Supporting, maintaining airway
      - IV access
      - Antipyretics per protocol
      - Transport, position of comfort
      - Supplemental humidified O₂
      - Respiratory failure/arrest, ET 0.5/1.0 mm smaller than normal

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Peritonsillar abscess (PTA)
    - Bacterial infection on back of the oropharynx
    - Rooted in adenoid tonsil tissue

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Peritonsillar abscess (PTA)
    - History and physical findings
      - Fever
      - Notable difficulty swallowing
      - Headache
      - Malaise
      - Neck pain
      - “Hot potato voice”
      - Unilateral swelling of posterior throat
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Peritonsillar abscess (PTA)
    - Therapeutic interventions
      - Patient calm, comfortable, position of comfort
      - O₂, pulse oximeter, saturation >95%
      - If respiratory failure/arrest, bag-mask with 100% O₂
      - IV fluids
      - Antipyretics per protocol

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Foreign body airway obstruction
    - Upper airway blockage by foreign object

Factors
- Seizures
- Intoxication by alcohol/drugs
- Decreased mental status
- Chronic medical conditions
- TIA, cerebrovascular accident
- Respiratory distress
- Feeding tubes
- Bowel structures
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Foreign body airway obstruction
    - History and physical findings
      - Sudden, severe coughing
      - Wheezing with no asthmatic history
      - Inability to speak
      - Unexplained dyspnea
      - Auscultation of lung, unilateral wheezing, rhonchi, crackles
      - Retractions
      - Drooling
      - Triad position

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Foreign body airway obstruction
    - Therapeutic interventions
      - Airway and oxygenation maintenance
      - Supplemental O₂
      - Cough to dislodge

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Foreign body airway obstruction
    - Complete obstruction
      - Abdominal/chest thrusts
      - Visual airway inspection, Magill forceps
      - Suction
      - Cricothyotomy per medical direction
      - Immediate removal
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Trauma
    - Penetrating, blunt neck trauma can be life-threatening

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Trauma
    - History and physical findings
      - MVC, blunt force seen
      - Cricoid cartilage positioned anteriorly, airway obstruction
      - Tracheal rings bruised, edema threatens airway

Upper Airway (Cont’d)

- Acute upper airway disorders
  - Trauma
    - Therapeutic interventions
      - Cervical spine precautions
      - Changes in vital signs, dyspnea, changes in voice, hoarseness, upper airway stridor, accessory muscle use
      - Bleeding, aggressive airway management
      - In-line cervical spine stabilization
      - Suction, oxygenation
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Tracheostomy
    + Hole surgically placed in the trachea to support respiration
    + Indications
      - Obstructive sleep apnea
      - Pickwickian syndrome
      - Upper airway obstruction/cancer
      - Laryngeal cancer
      - Ventilator support for 2+ weeks

- Drawbacks
  - Lung infections
  - Pneumonia
Upper Airway (Cont’d)

- Acute upper airway disorders
  - Tracheostomy
    - Therapeutic interventions
      - Dyspnea, additional O₂
      - Assisted with bag-mask connected directly to tracheostomy hub
      - Displacement, transfer to ED
      - Intubate through ostomy hole

Pleura, Mediastinum, Chest Wall Disorders

- Anatomy and physiology
  - Chest wall
    - Multiple layers of skin, bone, muscle, connective tissue

Pleura, Mediastinum, Chest Wall Disorders (Cont’d)

Thorax Bones, Muscles
Pleura, Mediastinum, Chest Wall Disorders (Cont’d)

- Anatomy and physiology
  - Respiration
    - Inspiration, signal passed from brain
    - Diaphragm contracts
    - Thoracic cavity increases

Pleura, Mediastinum, Chest Wall Disorders (Cont’d)

- Mediastinum
  - Area between lungs
  - Heart
  - Aorta
  - Inferior, superior venae cava
  - Trachea
  - Main bronchi
  - Does not directly contribute to respiration
  - Allows return of deoxygenated blood, circulation of oxygenated blood
Anatomy and physiology
- Chemosensitive areas
  - CO₂ levels increase, respirations increase
  - CO₂ levels decrease, respirations decrease
- Hypoxic drive
  - Primary drive for respiration fails, drives respirations
  - Never withhold O₂

Costochondritis
- Benign chest pain
- History and physical findings
  - Inflammation of cartilage connecting the ribs to sternum
  - Joints affected
  - Infection
  - Strain, sprain
  - Worse with deep breathing

Costochondritis (Cont'd)
- Therapeutic interventions
  - Antiinflammatory medications
  - O₂
  - IV access
  - Pulse oximetry, capnography, cardiac monitoring
  - Analgesics per medical direction
Pleurisy

- Painful rubbing of pleural lining
- Etiology
  - Visceral pleura
  - Parietal pleura

- History and physical findings
  - Pain worsened by breathing
  - Shallow breaths
  - Nausea, vomiting
  - Diaphoresis
  - Auscultation of lungs reveals "rub"
  - Hypoxic from decreased respirations to avoid pain

- Therapeutic interventions
  - Oxygenation saturation
  - Monitoring capnography
  - ECG monitoring
  - IV access
Pneumomediastinum
- Air in mediastinum
- Etiology
  - Spontaneously
  - Chest trauma
  - Mechanical ventilation
  - Asthma
  - Emphysema
  - Lung/chest tumors
  - Cocaine use
  - Violent emesis/coughing
  - Childbirth
  - Alveoli rupture, air into surrounding structures
  - Bacteria, infection

History and physical findings
- Indistinct chest pain
- Mild dyspnea
- Subcutaneous emphysema
- Hamman's sign

Therapeutic interventions
- Oxygenation
- Ventilation
- IV access
- ECG monitoring
- Rapid transport
Lower Airway

- Anatomy of lower airway
  - Trachea
  - Bronchi
  - Bronchioles
  - Alveoli

Lower Airway (Cont’d)

- Anatomy of lower airway
  - Sterile
  - Mucus production
  - Air distributed to alveoli
  - Metabolism byproducts
Lower Airway (Cont’d)

Lung Tissue Gas Exchange

Lower Airway (Cont’d)

Assessment
- Continuous
- Discontinuous
- Both upper lobes
- Middle lung
- Lower lobes
- Posterior from the bottom

Lower Airway (Cont’d)

Lung Lobes
Lower Airway (Cont’d)

- Assessment
  - Abnormal breath sounds
    - Stridor
      - Harsh, high-pitched inspiratory sound over the neck
      - Restricted movement through the upper airway
      - Larynx, trachea obstruction
  - Crackles
    - Rales, wet lung sounds
    - Fluid in smaller airways
    - Pneumonia, pulmonary edema
    - Infection: discontinuous
    - Fine
    - Medium
    - Coarse
  - Rhonchi
    - Rattling, rumbling
    - Continuous, louder during exhalation
    - Fluid in larger airways
    - Cleared by coughing
    - Pneumonia
    - Congestion from URIs, COPD
Lower Airway (Cont’d)

- Assessment
  - Abnormal breath sounds
    - Wheezing
      - Musical whistling
      - Turbulent air movement through the constricted bronchioles
      - Continuous, louder during exhalation
      - Pitches singular, variable
  - Cause
    - Asthma, COPD
    - Toxic inhalation
    - Bronchospasm
    - Congestive heart failure
    - Emphysema
    - Croup
    - Pneumothorax
    - Pneumonia
    - Anaphylaxis
    - Foreign body obstruction, tumor
    - Pulmonary edema

Lower Airway (Cont’d)

- Traumatic pleural and pulmonary injuries
  - Pneumothorax
    - Partial/full lung collapse

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Lower Airway (Cont’d)

- Traumatic pleural and pulmonary injuries
  - Pneumothorax
    - Etiology
      - Trauma
      - Rib fractures
      - Spontaneous without underlying lung disease
      - Spontaneous with underlying lung disease
      - Mechanical ventilation
      - Barotrauma

Lower Airway (Cont’d)

- Traumatic pleural and pulmonary injuries
  - Pneumothorax
    - Sudden onset
      - Dyspnea
      - Chest pain
      - Tachycardia hypoxia
      - Hypoventilation
      - Cough
      - Diaphoresis
      - Altered mentation
      - Cyanosis
      - Subcutaneous emphysema

Lower Airway (Cont’d)

- Traumatic pleural and pulmonary injuries
  - Pneumothorax
    - Therapeutic interventions
      - Oxygenation, ventilation
      - IV access
      - Pulse oximetry
      - Capnography
      - ECG monitoring
      - Position of comfort
      - Tension pneumothorax possible
Nontraumatic Lung Diseases

- Pleural effusion
  - Fluid collects in the pleural cavity
    - Water, protein, white blood cells, plasma components

Nontraumatic Lung Diseases (Cont'd)

- Pleural effusion
  - Causes
    - Congestive heart failure
    - Bacterial pneumonia
    - Cancer
    - Pulmonary embolus
    - Advanced liver disease
    - Pancreatitis
    - Vascular disease
    - TB

Nontraumatic Lung Diseases (Cont'd)

- Pleural effusion
  - History and physical findings
    - Underlying causes
    - No breath sounds in lower lung part
    - Pleural friction rub
    - Tactile fremitus
    - Egophony
    - Bronchophony
    - Accessory muscle use
Nontraumatic Lung Diseases (Cont'd)

- Pleural effusion
  - Therapeutic interventions
    - Oxygenation, ventilation
    - IV access
    - Pulse oximetry
    - Capnography
    - ECG monitoring

Nontraumatic Lung Diseases (Cont'd)

- Noncardiogenic pulmonary edema
  - Condition in which fluid builds up in the alveoli in the absence of heart failure

Nontraumatic Lung Diseases (Cont'd)

- Noncardiogenic pulmonary edema
  - Etiology
    - High permeability in capillary beds
    - Fluid leaks into the interstitial space and alveoli
    - Plasma proteins leave the capillary beds, increase oncotic pressure, further fluid escape
    - Surfactant production decreases, alveolar collapse
    - Widened interstitial space interferes with diffusion, $\text{CO}_2$
Nontraumatic Lung Diseases (Cont'd)

- Noncardiogenic pulmonary edema
  - Causes
    - High altitude
    - Pulmonary embolus
    - Drowning
    - Acute glomerulonephritis
    - Fluid overload
    - Aspiration
    - Inhalation injury
  - Neurogenic pulmonary edema
  - Allergic reaction
  - Acute respiratory distress syndrome
  - Cause not understood

- History and physical findings
  - Distinguish from heart failure
  - Lack of jugular venous distention
  - Lack of peripheral edema
  - Adequate cardiac output, end-organ perfusion
  - Initial insult

- Primary findings
  - Dyspnea
  - Orthopnea
  - Crackles
  - Rales
  - Tachypnea
  - Tachycardia
  - Hypoxemia
  - Hypoxia
  - Anxiety
Nontraumatic Lung Diseases (Cont’d)

- Noncardiogenic pulmonary edema
  - Therapeutic interventions
    - Oxygenation, ventilation
    - IV access
    - Pulse oximetry, capnography, ECG monitoring
    - Continuous positive airway pressure
    - Elevate the upper body, dangle the feet
    - Inflatable pressure bag, descend altitude
    - Diuretics

Nontraumatic Lung Diseases (Cont’d)

- Acute respiratory distress syndrome
  - Alveoli damaged from illness/injury
  - Impair O₂, CO₂ exchange
  - Respiratory failure, dyspnea, hypoxia, pulmonary edema

Nontraumatic Lung Diseases (Cont’d)

- Acute respiratory distress syndrome
  - Possible triggers
    - Aspiration
    - Cardiopulmonary bypass surgery
    - Sepsis
    - Multiple blood transfusions
    - O₂ toxicity
    - Trauma, burns
    - Pneumonia, TB
Nontraumatic Lung Diseases (Cont’d)

- Acute respiratory distress syndrome
  - History and physical findings
    - Preceded by massive insult
    - Signs
      - Shortness of breath
      - Rapid breathing
      - Inadequate oxygenation
      - Decreased lung compliance

- Therapeutic interventions
  - O₂
  - Pulse, oximeter, capnography, ECG monitor
  - Positive end-expiratory pressure/continuous positive airway pressure

Obstructive and restrictive pulmonary diseases

- Asthma
  - Reactive airway disease
  - Maintains normal acid-base balance
  - Prolonged attack, respiratory acidosis
  - Components
    - Bronchospasm
    - Bronchial edema
    - Excessive mucus production
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Asthma
    - Etiology and demographics
    - Allergies
    - Middle, lower airways develop edema
    - Bronchial smooth muscle contraction
    - Bronchial wall edema, thickening
    - Thick secretions
    - Preceded by upper respiratory infection

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Asthma
    - History and physical findings
    - Exposure to trigger causes acute onset of respiratory distress
    - Bronchial collapse more prevalent during exhalation, air trapping, hyperinflation of lungs
    - Chest tightness
    - Inhalation inability

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Asthma
    - History and physical findings
    - Current compared to past episodes
    - Successful and unsuccessful therapies
    - Prescribed inhaler use
    - Medical condition, contraindication for corticosteroids
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Asthma
    - History and physical findings
      - Other medications may have caused attack, inhibit treatment (aspirin, beta-blockers)
      - Tripod position
      - Dyspnea, wheezing, cough
      - Distinguish between clear and absent lung sounds

- Findings
  - Anxiety
  - Agitation
  - Tachypnea
  - Tachycardia
  - Difficulty completing sentences
  - Prolonged expiration
  - Palor, cyanosis
  - Decreased muscle tone
  - Accessory muscle use

- Impending respiratory failure
  - Patient fatigue
  - Absent breath sounds
  - Profound diaphoresis
  - Altered mental status
Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Asthma
    - Peak flow meter

- Capnography
  - Bronchoconstriction, prolonged expiration before shark fin waveform
  - Elevated ETCO₂ levels, prolonged episode

- Therapeutic interventions
  - Ventilation, oxygenation
  - Position of comfort, humidified O₂
  - Continuous positive airway pressure (CPAP)
  - Pulse oximeter, capnography, cardiac monitor
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Asthma
    - Therapeutic interventions
      - Nebulizer therapy
      - IV corticosteroids, adjunct
      - Theophylline, in addition to inhaled beta agonists, adjunct
      - Epinephrine, full respiratory failure, intramuscularly
      - Status asthmaticus, respiratory failure

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Bronchiolitis
    - Acute, infectious inflammatory disease
    - Upper, lower airway tracts
    - Obstruction of small airways

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Bronchiolitis
    - Risk factors
      - Low birth weight
      - Crowded living conditions
      - Daycare exposure
      - Smoking exposure
      - Chronic heart and lung conditions
      - Respiratory syncytial virus
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Bronchiolitis
    - History and physical findings
      - Bronchiole obstruction from inflammation, edema
      - Hyperinflation of the lungs
      - Increased wheezing
      - Course crackles
  - Nasal flaring
  - Grunting
  - Cyanosis
  - Crackles
  - Wheezing
  - Apnea rarely
  - Atelectasis
  - Dehydration differentiates it from asthma
  - Tachycardia
  - Tachypnea
  - Accessory muscle use

- Therapeutic interventions
  - Supportive
  - Position of comfort
  - Pulse oximeter, capnography
  - \( O_2 \) saturation >95%
  - Nebulized beta agonists
  - Hydration
Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Bronchopulmonary dysplasia
    - Child needing O₂ supplementation at 28 days, maintain PO₂ of 50 mm Hg
    - Inflammation, scarring of smaller airways and alveoli

Etiology and demographics
- Prolonged positive-pressure ventilation, high O₂ concentrations

History and physical findings
- Premature, low birth weight
- Tachypnea
- Tachycardia
- Retractions
- Nasal flaring
Nontraumatic Lung Diseases
(Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Bronchopulmonary dysplasia
    - Auscultation
      - Decreased breath sounds
      - Rhonchi
      - Fine crackles
      - Wheezing

- Therapeutic interventions
  - O₂, be careful of amount
  - O₂ saturation, 90-95%
  - Supportive care

Nontraumatic Lung Diseases
(Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Bronchopulmonary dysplasia
    - Therapeutic interventions
      - O₂, be careful of amount
      - O₂ saturation, 90-95%
      - Supportive care

Nontraumatic Lung Diseases
(Cont'd)

- Obstructive and restrictive pulmonary diseases
  - COPD
    - Description
      - Bronchitis
      - Emphysema
      - Asthma
      - Varying degrees/combination
      - Long-term tobacco abuse, exposure to inhaled toxins
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - COPD
    - Bronchitis is predominant
      - Mucus overproduction
      - Cell enlargement in lungs, airways
      - Productive cough 3+ months, 2+ years
      - Hypoventilation of alveoli, drops O₂ level in blood
      - Acidosis
      - Increased cardiac output, RBC production

Nontraumatic Lung Diseases (Cont'd)

- Emphysema
  - Involves alveoli
  - Alveolar destruction
  - Alveolar coalescence
  - Destruction of elastin fibers surrounding the alveoli
  - Chronic hypoxia, hypercarbia
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - COPD
    - Emphysema
      - Blebs on lung surface, possible pneumothorax
      - Polypnosis
      - Muscle wasting, malnourished appearance
      - Barrel chest
  - Asthma
    - Bronchial hyperstimulation, constriction
    - Wheezing, dyspnea

- COPD
  - Chronic dyspnea
  - Little or no cough, little mucus production
  - Tripod position
  - Mental status changes
  - Heart problems, cor pulmonale, ventricular failure
Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - COPD
    - Therapeutic interventions
      - Oxygenation, ventilation
      - O2 saturation at least 90%

Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - COPD
    - Therapeutic interventions
      - Respiratory distress causes
      - CO2 narcosis
      - Reduce bronchoconstriction alveolar secretions
      - IV access
      - ECG monitoring, pulse oximetry, capnography, peak expiratory flow testing
      - Transport, reassess

Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Cystic fibrosis
  - Genetic disease
  - Pulmonary distress complication
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Cystic fibrosis
    - Etiology and demographics
      - Thicker secretions
      - Lung disease
      - Liver, pancreas
      - Whites
      - Median life span, 36.8 years

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Cystic fibrosis
    - History and physical findings
      - Similar presentation to COPD, pneumonia
      - Cough
      - Chest wall pain, tender
      - Dyspnea
      - Fever
      - Crackles

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Cystic fibrosis
    - Therapeutic interventions
      - Supplemental O₂ ventilation
      - Monitor oxygenation, ventilatory, cardiac functions
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pneumonia
    - Infection in terminal breathing spaces, alveoli

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pneumonia
    - Virus
      - Respiratory syncytial virus
      - Parainfluenza
      - Influenza
      - Adenovirus

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pneumonia
    - Bacteria
      - Haemophilus influenzae
      - Streptococcus pneumoniae
      - Mycoplasma spp.
      - Klebsiella spp.
      - Pseudomonas spp.
    - Fungi
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pneumonia
    - Lobar pneumonia
      - Localized to 1+ lung lobes
  - Bronchopneumonia
    - Inflammation around medium-sized airways, patchy consolidation of parts of lobes
  - Interstitial pneumonia
    - Lung tissue inflammation between air sacs

- Pneumonia
  - Typical pneumonia signs/symptoms
    - Acute onset, fever, chills
    - Productive cough with purulent sputum
    - Pleuritic chest pain
    - Pulmonary consolidation on auscultation
    - Location of bronchial breath sounds
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pneumonia
    - Typical pneumonia signs/symptoms
      - Crackles
      - Lethargy
      - Anorexia
      - Tachypnea
      - Tachycardia
      - Chest, side, back pain
    - Atypical pneumonia
      - Nonproductive cough
      - Extrapulmonary symptoms
      - Headache
      - Myalgias
      - Fatigue
      - Sore throat
      - Nausea, vomiting, diarrhea
      - Fever, chills
  - Complicating factors, difficult treatment
    - Age
    - COPD
    - Heart disease
    - Alcoholism
    - Diabetes
    - AIDS
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pneumonia
    - Therapeutic interventions
      - Optimize oxygenation
      - Respiratory status monitoring
      - ET intubation
      - IV access
      - Hypovolemic, septic shock treatment
      - Antibiotics
      - Personal protective equipment (PPE)

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Lung abscess
    - Pus collections in lung tissues
    - Aspirated gastric contents

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Lung abscess
    - History and physical findings
      - Productive cough of sputum with unusual odors
      - Dyspnea
      - Fever
    - Night sweats
    - Decreased appetite
    - Weight loss
    - Chest/chest wall pain
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Lung abscess
    - Low grade fever
    - Tachypnea
    - Tachycardia
    - Crackles
    - Rhonchi
    - Decreased breath sounds
    - Percussion dullness
    - Empyema, pus collection outside lung in pleural space

- Lung abscess
  - Therapeutic interventions
    - Supplemental O2
    - Supportive care
    - Intubate
    - Antibiotics

- Aspiration pneumonia and pneumonitis
  - Gastric acid, food
  - Inflammatory response
  - Hypoxia, respiratory failure
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Aspiration pneumonia and pneumonitis
    - At risk
      - Altered mental status
      - Intoxicated
      - Chronic disability
      - Feeding tubes
      - Stroke history
      - Head trauma
      - Airway control problems

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Aspiration pneumonia and pneumonitis
    - Aspiration pneumonitis
      - Lung bronchoalveolar irritation, aspirated stomach acid
      - Swelling in alveoli
    - Aspiration pneumonia
      - Bacteria in lower lungs
      - Pulmonary abscess possible

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - History and physical findings
    - Dyspnea, airway obstruction
    - Altered mental status
    - Fever
    - Chills
    - Dyspnea on exertion
    - Orthopnea
    - Pleuritic chest pain
    - Productive cough
    - Respiratory distress
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Aspiration pneumonia and pneumonitis
    - Therapeutic interventions
      - Aggressive airway control
      - IV access
      - Standard monitoring

- Aspiration pneumonia and pneumonitis
  - Therapeutic interventions
    - Aggressive airway control
    - IV access
    - Standard monitoring

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary tuberculosis
    - Pulmonary disease
    - Mycobacterium tuberculosis
    - Transmitted via airborne droplets

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary TB
    - Stage 1
      - Bacterium inhaled into lung
      - Standard inflammatory immune responses triggered
      - If defenses contain, eradicate bacteria, does not progress
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary TB
    - Stage 2
      - Bacteria multiply rapidly
      - Tubercle formed, infected lung area
      - Infection spreads throughout the lymphatic system, vascular system, body
      - Possible extra pulmonary TB
      - Pericarditis, peritonitis, GI disease

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary TB
    - Stage 3
      - 2-3 weeks after first stage
      - Inflammatory, immune responses contain spread of infectious organisms
      - Granulomas formed, tissue destruction occurs
      - Dormant survival, years

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary TB
    - Stage 4
      - Dormant bacteria reactivates
      - Tubercle erodes, releases contained bacteria back into the lung
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary TB
    - Active TB
      - Productive cough
      - Fever
      - Weight, appetite loss
      - Hemoptysis
      - Chest, chest wall pain
      - Fatigue
      - Irritability
      - Weakness
      - Headaches
      - CNIs
      - Fever
      - Night sweats

- Pulmonary TB
  - Elderly
    - Atypical presentation
    - Chronic cough
    - Failure to thrive
    - Fewer respiratory symptoms
    - Fever
    - Dryness
    - Rhonchi, rales
    - Upper lobe affinity

- Therapeutic interventions
  - Detailed history of TB exposure
  - Initiate respiratory isolation with masks
  - Notify the ED ASAP
  - Emergent risk
  - PPE
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary thromboembolism

  - Pulmonary embolus
    - Thrombus becomes dislodged, travels through the bloodstream
    - Lodges in the pulmonary artery, obstructs blood flow to portion of the lung
    - Often start in leg, through inferior vena cava, to right ventricle, pulmonary artery

- Etiology and demographics
  - Difficult to diagnose
  - Wide range of clinical signs
  - Sudden death
  - Comorbid conditions
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary thromboembolism
    - History and physical findings
      - Virchow's triad
      - Sedentary lifestyle
      - Smoking
      - Deep vein thrombosis history
      - Long bone fractures
      - Pregnancy
      - Recent leg or hip surgery
      - Contraceptive use
      - Stasis of position

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary thromboembolism
    - Right-to-left shunt
    - Atelectasis
    - Hypoxemia
    - Pulmonary hypertension
    - Right heart strain

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary thromboembolism
    - Hypotension
    - Acute onset dyspnea (50%)
    - Pleuritic chest pain (two-thirds)
    - Anxiety
    - Tachycardia
    - Fever
Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Pulmonary thromboembolism
    - Cough
    - Chills
    - Mucus production
    - Tachypnea
    - Skin cool, pale, diaphoretic, cyanotic
    - If hypotensive, shock index >1

- Pulmonary thromboembolism
  - Therapeutic interventions
    - Supplemental O₂
    - IV access
    - ECG monitoring

ECG
Nontraumatic Lung Diseases
(Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Hyperventilation syndrome
    - Excess ventilation
    - Tachypnea/rapid respirations
    - Hyperpnea
    - Respiratory alkalosis caused by increased CO₂ elimination

Nontraumatic Lung Diseases
(Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Hyperventilation syndrome
    - History and physical findings
      - Preceding stressful or emotional event
      - “Not getting enough air”
      - Tingling in finger tips, toes, around the mouth
      - Chest pain
      - Dizziness, lightheadedness

Nontraumatic Lung Diseases
(Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Hyperventilation syndrome
    - Physical findings
      - Agitation
      - Anxiety
      - Tachypnea
      - Tachycardia
      - Generalized weakness
      - Syncope
      - Hypocalcaemia
      - Carpopedal spasm
      - Trousseau’s sign
      - Lung sounds clear
      - O₂ saturation, 100%
Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Hyperventilation syndrome
    - Therapeutic interventions
      - Coaching to slow respiratory rate
      - O₂, ECG
      - IV access

Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Atelectasis
    - Partial/full alveoli collapse in parts of the lung
    - Lung fully expanded
    - Inhibits oxygenation

Nontraumatic Lung Diseases (Cont’d)

- Obstructive and restrictive pulmonary diseases
  - Atelectasis
    - Etiology and demographics
      - Failure to take deep breaths regularly
      - After surgery
      - Risk for pneumonia
      - Prevented by regular coughing, deep breathing
Nontraumatic Lung Diseases (Cont'd)

Obstructive and restrictive pulmonary diseases
- Atelectasis
  - History and physical findings
    - Chest radiograph
    - Chest wall pain
    - Dyspnea
    - Coughing
    - Fever
    - Breath sounds, “snapping” on inhalation
    - ETCO₂ decreased

Nontraumatic Lung Diseases (Cont'd)

Obstructive and restrictive pulmonary diseases
- Atelectasis
  - Therapeutic interventions
    - Oxygenation
    - IV access
    - Standard respiratory monitoring

Tumors
- Benign, noncancerous
- Malignant, cancerous
- Primary
- Secondary
Nontraumatic Lung Diseases (Cont'd)

Lung Cancer

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Tumors
    - Undiagnosed
      - Malaise
      - Dyspnea on exertion
      - Hemoptysis
      - Weight loss
      - Long smoking history

Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Tumors
    - Examination
      - Thin
      - Palor
      - Cough
      - Hemoptysis
      - Fever
      - Stridor
      - Wheezing
Obstructive and restrictive pulmonary diseases

Tumors

- Examination
- Rhonchi
- Crackles
- Dyspnea
- Chest pain
- Low O₂ saturation
- Pulmonary effusion
- Absent breath sounds in lower lung

Therapeutic interventions

- O₂, assist respirations
- Advance directive before intubation, CPR
- Bronchodilators
- Pain relief

Environmental and occupational inhalation exposures

- Mixing chemicals
- Solvent-based chemical in enclosed spaces
Nontraumatic Lung Diseases (Cont'd)

- Obstructive and restrictive pulmonary diseases
  - Environmental and occupational inhalation exposures
    - History and physical findings
      - Similar to asthma
      - Dyspnea
      - Wheezing
      - Tachypnea
      - Anxiety
      - Coughing
      - Tearing
      - Drooling

- Therapeutic interventions
  - Remove the offending substance
  - Remove patient from the house
  - Crew safety
  - PPE
  - House ventilation

- Supportive care
  - Vital signs, O₂ saturation
  - Humidified O₂ >90%
  - Inhaled beta agonists
  - Identify offending agent
  - MSDS
  - Decontamination per protocol
Ventilator Management

- O₂-powered ventilators
  - Determine inspiratory time, inspired volume
  - Assist control (A/C)

Ventilator Management (Cont’d)

- O₂-powered ventilators
  - Synchronous intermittent mandatory ventilation (SIMV)
    - Inspire at will
    - Default rate
    - Partially/mostly awake

Ventilator Management (Cont’d)

- Noninvasive mechanical ventilation
  - Continuous positive airway pressure
    - Slight positive pressure delivery
    - Neuromuscular weakness
    - Chronic pulmonary edema
    - Obstructive sleep apnea
Ventilator Management (Cont’d)

Noninvasive mechanical ventilation

- Bilevel positive airway pressure
  - Delivered through tight-fitting mask
  - Two positive pressure levels delivered

Noninvasive mechanical ventilation

Respiratory failure

- Signs
  - Sleepy, intermittently combative, agitated
  - Decreased muscle tone
  - Decreased responsiveness level, response to pain
  - Inadequate respiratory rate, effort, chest excursion
  - Tachypnea with periods of bradycardia, slowing to bradypnea/agonal breathing
Ventilator Management (Cont’d)

- Noninvasive mechanical ventilation
  - Respiratory failure
    - Causes
      - Chest trauma
      - Head trauma
      - TIA
      - COPD
      - Status asthmaticus
      - Severe pneumonia
      - Intracranial hemorrhage
    - Drug, alcohol intoxication
    - Tension pneumothorax
    - Severe aspiration
    - Congestive heart failure

Chapter Summary

- Pulmonary dysfunction, result of interference with ventilation, interference with diffusion, interference with perfusion, combinations of factors
Indicators of life-threatening respiratory distress include:
- Alterations in mental status
- Dyspnea at rest
- Severe cyanosis
- Absent breath sounds
- Audible stridor
- Difficulty in speaking
- Tachycardia, pallor/diaphoresis
- Retractions/accessory muscle use

Hypoxia/hypercarbia can cause confusion, restlessness, irritability, lethargy, coma.
Indicators of respiratory compromise include inability to complete sentences, accessory muscle use in respiratory effort, pursed lips on exhalation.

Patients in respiratory distress are often tachycardic.
- Bradycardia associated with severe hypoxia may indicate imminent cardiac arrest.
- Diagnostic tools available for evaluation of respiratory distress; effectiveness of treatment includes pulse oximetry, peak flow meters, capnography.
Chapter Summary (Cont’d)

- Respiratory diseases categorized as two major varieties: upper respiratory conditions and lower respiratory conditions
- Upper respiratory diseases affect/limit inspired/expired air
  - Upper respiratory infection can cause a wide array of respiratory symptoms, including headache, nasal congestion, nasal drainage, nasal inflammation, sore throat, coughing, muscle aches, mucus production with cough, fever, chills

Chapter Summary (Cont’d)

- Epiglottitis, potentially life-threatening infection of supraglottic structures of airway resulting in inflammation of the base of the tongue, aryepiglottic folds, arytenoids, tonsils, epiglottis itself
  - Requires rapid transport, specialty care

Chapter Summary (Cont’d)

- Croup (laryngotracheobronchitis) affects young children, manifested by infection of the upper airways
  - Area below the glottis is most commonly affected, resulting in swollen, inflamed mucosa
- Bacterial tracheitis, serious infection of the trachea often requiring hospitalization
Chapter Summary (Cont’d)

• Peritonsillar abscess, painful, frightening illness
  ➢ Begins when bacterial infection forms on the back of the oropharynx, rooted in richly vascular tissues of adenoid tonsils
  ➢ Rarely may compromise upper airway
• Foreign bodies in airway can range from pins/needles to toys; the majority of patients are young children, some adults

Chapter Summary (Cont’d)

• Penetrating, blunt trauma to neck has the potential to generate life-threatening injuries; most result from knife/gunshot wounds
  ➢ Blunt trauma more frequently seen in motor vehicle crashes
  ➢ Direct-force blunt trauma to cricoid cartilage is capable of crushing cartilage, creating airway obstruction

Chapter Summary (Cont’d)

• In some chronic medical conditions, tracheostomy must be surgically performed to support respiration
• Costochondritis, inflammation of cartilage in anterior chest that causes chest pain
• Pleurisy, painful rubbing of pleural lining, cause of the inflammation is often unknown
Chapter Summary (Cont’d)

- Air in mediastinum is called pneumomediastinum, may occur spontaneously or as a result of trauma to the chest, mechanical ventilation, asthma, emphysema, lung/chest tumors, cocaine use, violent emesis/coughing, childbirth, among other causes.

- Lower respiratory diseases limit the ability of the body to oxygenate blood.

Chapter Summary (Cont’d)

- Pneumothorax, collection of air in pleural space
  - Spontaneous pneumothorax occurs in the absence of trauma
  - Primary spontaneous pneumothorax occurs without underlying lung disease
  - Secondary spontaneous pneumothorax occurs with underlying lung disease

Chapter Summary (Cont’d)

- Fluid collected in pleural cavity, pleural effusion
  - Pulmonary embolism, common cause of pleural effusions in patients <40 years old, coexisting embolus must be considered
  - Noncardiogenic pulmonary edema (NCPE), fluid accumulates in the alveoli in the absence of heart failure, noted in overdoses secondary to opioids, salicylates, cyclic antidepressants, other medications.
Chapter Summary (Cont’d)

- Acute respiratory distress syndrome, alveoli are damaged because of significant illness/injury
  - Some alveoli collapse, others fill with fluid, impairing exchange of oxygen and carbon dioxide
  - As the syndrome progresses, more alveoli are affected, gas exchange is further impaired, respiratory failure ensues resulting in dyspnea, hypoxia, pulmonary edema

Chapter Summary (Cont’d)

- Asthma, type I allergic reaction associated with inflammatory response, expressed in lower airways
  - Reactive airway disease, underestimated

Chapter Summary (Cont’d)

- Bronchiolitis, acute, infectious, inflammatory disease of the upper and lower respiratory tracts that results in obstruction of small airways; larger airways of older children and adults tolerate respiratory syncytial virus infection better than the airways of infants
Chapter Summary (Cont’d)

- Bronchopulmonary dysplasia may occur in preterm infants as a result of prolonged treatment with positive-pressure ventilation, high oxygen concentrations.
- COPD may include varying degrees of bronchitis, emphysema, asthma; usually caused or worsened by tobacco abuse.

Chapter Summary (Cont’d)

- Cystic fibrosis (CF), genetic disease in which glands create thicker-than-normal secretions that cause chronic infections, resulting in the most common complication of the disease—pulmonary infections.
  - Most fatalities from the disease result from progressive lung disease.

Chapter Summary (Cont’d)

- Pneumonia, infection in alveoli, particularly deadly in elderly, can be caused by a wide variety of pathogens, ranging from bacteria to fungi to viruses; can prevent oxygenation, requires aggressive medical treatment.
Pulmonary abscesses, collections of pus in lung tissue itself, often the result of aspiration of gastric contents; can take weeks to develop clinical signs.

Empyema is a collection of pus outside the lung in the pleural space.

Inspiration of fluids not intended for lungs is aspiration.

Aspiration of gastric acid, food from upper airway/stomach can cause inflammatory response, can lead to hypoxia, respiratory failure.

Aspiration pneumonitis is lung, bronchoalveolar irritation caused by aspirated stomach acid.

Tuberculosis (TB), pulmonary disease caused by the bacterium *Mycobacterium tuberculosis*, transmitted by airborne droplets.

Active TB is characterized by productive cough, fever, weight loss; symptoms include hemoptysis, chest/chest wall pain, weight/appetite loss, fatigue, irritability, weakness, headache, chills, fever, night sweats.

Requires respiratory isolation.
Chapter Summary (Cont'd)

- Pulmonary embolus (PE) occurs when a thrombus (clot) becomes dislodged, travels (clot is now embolus), lodging in pulmonary artery, obstructs blood flow to portion of the lung
  - Clot may consist of blood, fat, air
  - Difficult to diagnose, potentially fatal condition

Chapter Summary (Cont'd)

- Hyperventilation, excess ventilation, results in respiratory alkalosis secondary to increased elimination of carbon dioxide
  - Psychogenic hyperventilation is a diagnosis of exclusion; can be considered only after all other causes of respiratory distress are ruled out

Chapter Summary (Cont'd)

- Atelectasis, partial/full physical collapse of the alveoli in parts of the lungs; lung fully expanded, but collections of alveoli collapsed, inhibiting oxygenation
Chapter Summary (Cont’d)

- Pulmonary tumors have two varieties: benign (noncancerous) and malignant (cancerous)
  - Malignant tumors may originate in the lung (primary tumors) and may have spread from some other location, such as the liver, stomach, pancreas (called secondary tumors)

Chapter Summary (Cont’d)

- Environmental chemical exposures are often the result of mixing chemicals, usually cleaning products, use of solvent-based chemicals in enclosed spaces
  - Respiratory symptoms include dyspnea, wheezing, tachypnea, anxiety, coughing, sometimes coughing mucus, tearing, or drooling
  - Exposure to inhaled toxins immediately managed by removal of the patient and medical team to a safe area

Chapter Summary (Cont’d)

- Continuous positive airway pressure (CPAP), delivery of slight positive pressure to prevent airway collapse, improve oxygenation, ventilation in spontaneously breathing patients
  - Patient wears mask that covers mouth, nose, providing continuous increased airway pressure throughout the respiratory cycle as patient breathes
  - CPAP may be used to assist ventilation in patients with neuromuscular weakness, chronic pulmonary edema, obstructive sleep apnea
Chapter Summary (Cont’d)

- Bilevel positive airway pressure (BiPAP), delivered through tight-fitting mask
  - Two levels of positive pressure are delivered: one is delivered during inspiration to keep the airway open as patient inhales; the other (lower) pressure is delivered during expiration to reduce the work of exhalation
- Care should be used when mechanically ventilating patients’ lungs to avoid pneumothorax

Questions?