Infections of the Lower Respiratory Tract

- Impairment of the normal defenses
  - Cilia
  - Mucus

Acute Bronchitis

- Inflammation of the bronchi
- Common among adults
Acute Bronchitis

- Pathophysiology
  - Follows an upper respiratory infection
  - People at risk—smokers, impaired defense mechanisms
  - Viruses, bacteria, toxic gases
  - Inflammation causing increased mucus production and cough

- Manifestations
  - Paroxysms (uncontrollable bursts) of coughing
  - Substernal chest pain
  - Fever, malaise

Pneumonia

- Inflammation of respiratory bronchioles and alveoli
- Leading cause of death in U.S. among older adult and people with debilitating disease
- Infectious
  - Bacteria
  - Viruses
  - Fungi
  - Protozoa
  - Other microbes
Pneumonia

- Noninfectious
  - Aspiration of gastric contents
  - Inhalation of toxic or irritating gases

Pneumonia

- Pathophysiology and Manifestations
  - Colonize the nasal and oral pharynx
  - Enter the lungs when secretions are aspirated
  - *Streptococcus pneumoniae* (pneumococcal pneumonia) – most common
  - Classified by cause or location

Pneumonia

- Types
  - Acute bacterial
    - *Pneumocystis carinii* pneumonia
    - Legionnaire's disease
    - Atypical
    - Viral
    - Aspiration
Pneumonia – Diagnostic Tests

- Sputum Gram stain
- CBC
- ABG
- Pulse oximetry
- Chest x-ray
- Fiberoptic bronchoscopy

Pneumonia - Treatment

- Immunization and prevention
- Medications
  - Antibiotics
  - Bronchodilators
  - Expectorants
- Oxygen therapy
- Other therapies

Pneumonia – Nursing Care

- Ineffective Airway Clearance
- Ineffective Breathing Pattern
- Activity Intolerance
Pneumonia – Continuing Care

- Teaching focused on prevention
- Immunizations
- Taking medications
- Limit activities to conserve energy
- Maintain nutrition and fluid intake

Tuberculosis

- Chronic recurrent infection of the lungs
- *Myobacterium tuberculosis*
- Health problem worldwide
- Pathophysiology
  - Slow-growing organism
  - Transmitted by droplet nuclei

Pulmonary Tuberculosis

- Alveolus or respiratory bronchiole
- Upper lobe
- WBCs phagocytize and isolate bacteria
- Sealed off colony of bacilli (tubercle)
- Scar tissue forms around tubercle
- Reactivation tuberculosis
Pulmonary Tuberculosis

- Manifestations
  - Fatigue
  - Fever
  - Weight loss
  - Night sweats
  - Cough

Extrapulmonary Tuberculosis

- Develop in other organs active or dormant
- Kidney or GU tract
- Large weight-bearing joints
- Miliary tuberculosis
- Tuberculosis meningitis
- Manifestations
  - Vary depending on organ involved

Tuberculosis

- Collaborative focus
  - Early detection
  - Effective treatment
  - Preventing spread
- Screening
  - Tuberculin test
  - Purified protein derivative (PPD) injected (Mantoux test)
Tuberculosis – Diagnostic Tests

- Acid-fast bacilli smear and culture
- Chest x-ray
- Fiberoptic bronchoscopy

Tuberculosis – Treatment

- Medications
  - Drugs to prevent and treat
  - INH (isoniazid)
  - Two antitubercular drugs
  - Treated for a period of 6 months

Tuberculosis – Nursing Care

- Assessment
- Risk for Infection
  - Negative flow room
  - HEPA-filtered respirator
  - Respiratory isolation
- Deficient Knowledge
- Ineffective Therapeutic Regimen Management
Tuberculosis – Nursing Care

- Continuing care
  - Teaching to reduce spread
  - Regular screening of high-risk individuals
  - Medication administration

Lung Abscess and Empyema

- Potential complication of pneumonia and other respiratory infections
- Local lung destruction or necrosis and pus formation
- Aspiration pneumonia common cause

Lung Abscess and Empyema

- Empyema = Pus in the pleural cavity
  - Causes
    - Bacterial pneumonia
    - Rupture of lung abscess
    - Infection from chest trauma
  - Manifestations
    - Two weeks after initiating event
    - Signs of acute infection
    - Treatment with antibiotics
Emerging Respiratory Infections

- Severe acute respiratory syndrome (SARS)
- Virus called SARS-associated coronavirus
- Inhalation anthrax
  - *Bacillus anthracis*

Obstructive and Restrictive Lung Disorders

- Airflow decreases
  - Secretions obstruct airway
  - Airway walls are edematous or swollen
  - Smooth muscle of airways constricts
  - Lungs lose elasticity
  - Supportive tissue lost

Obstructive and Restrictive Lung Disorders

- Results in
  - Increased work of breathing
  - Air trapping
  - Less oxygen for gas exchange in the alveoli
Asthma

- Chronic inflammatory disorder
- Recurrent episodes of
  - Wheezing
  - Breathlessness
  - Chest tightness
  - Coughing
- Common in children and adults

Asthma - Pathophysiology

- Inflammatory response triggered by:
  - Tobacco smoke
  - Smog
  - Workplace pollutants
  - Respiratory infection
  - Exercise
  - Stress
  - Drugs

Asthma - Pathophysiology

- Early response
  - Inflammatory mediators
    - Bronchoconstriction
    - Increased capillary permeability
    - Edema and narrowing of airways
Asthma - Pathophysiology

- Late-phase response
  - 4–12 hours after exposure
  - Activation of inflammatory cells
  - Air is trapped distal to narrow airways
  - Blood flow is reduced to distended alveoli
  - Hypoxemia develops

Asthma - Manifestations

- Attacks may be abrupt or develop slowly
- Chest tightness
- Difficulty breathing
- Wheezing
- Cough
- Prolonged expiration
- Increased heart rate and respiratory rate
- Anxiety
Asthma - Manifestations

- Status asthmaticus
  - Severe prolonged asthma that does not respond to routine treatment
  - Can lead to respiratory failure

Asthma

- Diagnosis by history and manifestations
- Peak expiratory flow rate
- Pulse oximetry and arterial blood gases
- Treating and controlling symptoms to prevent acute attacks
- Preventive measures
  - Avoid allergens

Asthma - Treatment

- Medications
  - Anti-inflammatory agents
  - Rapid and long-acting bronchodilators
  - Leukotriene modifiers
  - Anticholinergic drugs
  - Complimentary therapy
Asthma – Nursing Care

- Assessment of airway
- Ineffective Airway Clearance
- Fatigue
- Anxiety
- Ineffective Therapeutic Regimen Management

Asthma – Nursing Care

- Continuing care
  - Teaching PEFR monitoring
  - Use of short-acting inhalers
  - Medications
  - Prevention

Chronic Obstructive Pulmonary Disease (COPD)

- Progressive obstruction of airflow in the lungs
- Middle to older adults
- Smoking most common cause of COPD
- Second leading cause of disability and lost work time
COPD - Pathophysiology

- Airways are narrowed and gradually obstructed by
  - Inflammation
  - Excess mucous production
  - Loss of elastic tissue and alveoli
  - Two processes
    - Chronic bronchitis
    - Emphysema
  - Alveolar ventilation is impaired as is gas exchange

Chronic Bronchitis

- Chronic inflammatory airway disorder
  - Excessive secretion of thick tenacious mucus
  - Productive cough lasting 3 or more months
  - Narrowed airways due to mucosal edema and excess secretions
  - Expiratory airflow affected
  - Ciliary function impaired

Emphysema

- Destruction of alveolar walls
- Large abnormal airspaces
- Deficiency of alpha,-antitrypsin can cause
- Surface area for gas exchange decreases
- Alveoli become less elastic
- Air trapping
- Barrel chest
COPD – Diagnostic Tests

- Pulmonary function tests
- Serum alpha-1-antitrypsin levels
- ABGs
- Pulse oximetry
- Ventilation/perfusion scan
- Chest x-ray
- CT scan

COPD - Treatment

- Medications
- Oxygen therapy
- Smoking cessation
- Fluid and nutritional support
- Airway clearance procedures
- Breathing exercises
- Lung transplant or lung reduction surgery
COPD – Nursing Care

- Assessment of airway
- Ineffective Airway Clearance
- Imbalanced Nutrition: Less than Body Requirements
- Ineffective Coping
- Decisional Conflict: Smoking

COPD – Nursing Care

- Continuing care
  - Effective coughing and breathing exercises
  - Nutrition and fluid intake
  - Exercise and activity
  - Avoid crowds and infection exposure risks
  - Stress reduction
  - Recognition of symptoms
  - Medication administration

Cystic Fibrosis

- Heredity disorder of childhood
- Causes excess mucous secretion
- Thick mucus plugs small airways and impairs normal airway clearing mechanisms
Cystic Fibrosis

- Leads to atelectasis, infection, bronchiectasis, and airway dilation
- COPD, pulmonary hypertension develop over time
- Dyspnea, chest congestion, and chronic cough of thick sticky sputum

Cystic Fibrosis

- Diagnostic Tests
  - Pilocarpine iontophoresis sweat chloride test
  - Chest x-ray
  - Pulmonary function testing
- Treatment
  - Dornase alfa enzyme to liquefy secretions
  - Chest physiotherapy
  - Mediations to reduce inflammation and treat infection

Atelectasis

- Partial or total lung collapse and airlessness
- Acute or chronic
- Small or large segment of lung
- Compression or inability to keep alveoli open
- Prevention is primary treatment
Bronchiectasis
- Permanent dilation of large airways
- Repeated respiratory infections
- Secretions pool in dilated bronchial walls
- Chronic cough and production of large amounts of sputum
- Treatment similar to COPD

Interstitial Lung Disorders
- Inflammation damages alveoli and interstitial tissue
- Occupational lung disease
  - Exposure to inhaling noxious substances at work
  - Pneumoconiosis
  - Hypersensitivity pneumonitis

Interstitial Lung Disorders
- Sarcoidosis
  - Chronic systemic disease
  - Affects lungs, lymph nodes, liver, eyes, skin, and other organs
  - As lesions heal, scarring develops
Interstitial Lung Disorders – Nursing Care

- Assessment of airway and airway clearance
- Ineffective airway clearance
- Similar to COPD
- Continuing care
  - Teaching respiratory care techniques

Lung Cancer

- Leading cause of cancer deaths in the United States
- Most die within 1 year of diagnosis
- Cigarette smoking is most important cause
  - 85% related to smoking
- Other risk factors include radiation exposure and inhaled irritants

Lung Cancer

- Pathophysiology
  - Primary tumors arise from cells lining airways
  - Differ by cell type
  - Aggressive and locally invasive
  - Metastasize widely via lymph
Lung Cancer

- Sites for metastasis
  - Brain
  - Bones
  - Liver
  - Other organs
- Superior vena cava syndrome
  - Partial or complete obstruction of superior vena cava
Lung Cancer – Diagnostic Tests

- Chest x-ray
- Sputum cytology
- CT scan
- Bronchoscopy
- Percutaneous needle biopsy

Lung Cancer - Treatment

- Medications
  - Combination chemotherapy
- Surgery
- Radiation therapy
- Other therapies for symptom management
  - Thoracentesis

Lung Cancer – Nursing Care

- Assessment
  - Smoking history
  - Respiratory and cardiovascular status
- Ineffective Breathing Pattern
- Activity Intolerance
- Pain
- Anticipatory Grieving
Lung Cancer – Nursing Care

- Continuing care
  - Information about disease and expected outcome
  - Smoking cessation
  - Information on treatment and other services

Pulmonary Vascular Disorders

- Cardiovascular and respiratory systems are closely linked
- Airflow is affected by blockage or conditions that restrict blood flow to the lungs

Pulmonary Embolism

- Blockage of pulmonary artery
- Thromboemboli
- Also tumors, bone marrow fat, amniotic fluid, foreign matter
- Can be fatal
Pulmonary Embolism

Pathophysiology
- Begins as clot in deep veins of legs or pelvis
  - Clot breaks loose, travels to heart and enters the pulmonary artery
  - Clot is trapped, obstructing blood flow

Manifestations
- Symptoms depend on size and location
- Fat emboli from long bone fracture

Pulmonary Hypertension/Cor Pulmonale
- Abnormal elevation of pulmonary arterial pressure
- Causes can vary
- Long-standing can lead to cor pulmonale with right ventricular hypertrophy and failure
Pulmonary Hypertension/Cor Pulmonale

- Manifestations
  - Dyspnea
  - Fatigue
  - Angina
  - Syncope with exertion
  - Productive cough
  - Dyspnea and wheezing
  - Signs of right heart failure

Pulmonary Hypertension/Cor Pulmonale

- Diagnostic Tests
  - Plasma d-dimer levels
  - Ventilation-perfusion scan
  - Pulmonary angiography

Pulmonary Hypertension/Cor Pulmonale

- Treatment
  - Medications
    - Thrombolytic drugs
    - Anticoagulants
    - Calcium channel blockers
    - Rapid-acting direct vasodilators
  - Oxygen
  - Surgery
    - Umbrella-like filter in the inferior vena cava
Pulmonary Hypertension/Cor Pulmonale

Nursing care
- Assessment
  - Chest pain, shortness of breath
  - Identifying clients at risk
  - Vital signs, oxygen saturation

Diagnosis, planning, implementation
- Risk for Ineffective Tissue Perfusion: Cardiopulmonary
- Impaired Gas Exchange
- Decreased Cardiac Output
- Anxiety
- Activity Intolerance
- Fatigue

Continuing Care
- Anticoagulants
- Precautions to prevent bleeding
- Reduce risk of DVT
- Rest
Pleuritis

- Inflammation of the pleura
- Results from another process
  - Viral infection
  - Pneumonia
  - Rib injury

Pleuritis

- Symptoms
  - Onset abrupt
  - Pleuritic pain is sharp or stabbing and localized
  - Deep breathing, coughing aggravate pain
  - Breathing is rapid and shallow
  - Breath sounds diminished
  - Pleural friction rub
- Treatment
  - Analgesics
  - NSAIDs

Pleural Effusion

- Collection of excess fluid in pleural space
- Results from
  - Pneumonia
  - Cancer
  - Trauma
  - Heart failure
  - Kidney disease
Pleural Effusion

- Symptoms
  - Dyspnea and shortness of breath
  - Diminished breath sounds
  - Limited chest wall movement

Pleural Effusion

- Treatment
  - Thoracentesis
  - Pain control
  - Maintaining respiratory function

Figure 24-12. Thoracentesis. A needle is inserted between the ribs into the pleural space to withdraw excess pleural fluid.
Pneumothorax

- Accumulation of air in the pleural space
  - Can occur without cause
  - Due to chronic lung disease
  - Result of trauma

Pneumothorax

- Pathophysiology
  - Air enters pleural space
  - Pressure in space is no longer negative and lung collapses

- Types
  - Spontaneous
  - Traumatic open pneumothorax
  - Tension pneumothorax

Pneumothorax

- Manifestations
  - Dependent on the size and extent of lung collapse
  - Primary pneumothorax affects tall, slender, young adult men
  - Secondary pneumothorax occurs in people with preexisting lung disease, usually COPD
  - Both have an abrupt onset if chest pain and shortness of breath present
  - Tachypnea and tachycardia
  - Diminished breath sounds
  - Air heard or felt; deviated trachea
Pneumothorax

- Diagnostic tests and treatment
  - Chest x-ray
  - Treatment dependent on severity
  - Thoracentesis
  - Chest tubes to reexpand the lungs

Hemothorax

- Blood in the pleural space
- Chest trauma or surgery
- Symptoms similar to pneumothorax
- Treatment with thoracentesis or chest tubes

Chest Tubes

- Treatment for pneumothorax
- Closed-drainage system
- One-way valve
  - Water seal prevents air from entering chest cavity
**Pneumothorax – Nursing Care**

- Assessment of respiratory status and pain
- Impaired Gas Exchange
- Risk for Injury
- Altered Comfort
- Continuing care
  - Avoid smoking
  - Follow-up care and monitoring

**Chest and Lung Trauma**

- Due to external source that can affect chest wall and lung

**Rib Fracture**

- Single rib fracture most common chest wall injury
- Usually minor
- Can lead to pneumonia, atelectasis, and respiratory failure
- If displaced, can cause a tear in the pleura and cause pneumothorax
- Pain on inspiration
  - Bruising and crepitus
Flail Chest

- Two or more adjacent ribs broken
- Chest wall becomes free floating
- Paradoxic movement
  - Flail segment moves inward during inspiration and outward during expiration
- Pain and dyspnea
- Crepitus and diminished breath sounds

Figure 24-14. Flail chest with paradoxic chest wall movement.

A Fracture pattern of flail chest

Figure 24-14 (continued). Flail chest with paradoxic chest wall movement.

B Inspiration
C Elevation
Pulmonary Contusion

- Chest trauma when chest is rapidly compressed and then decompressed
- Alveoli and pulmonary vessels rupture
- Causes tissue hemorrhage and edema
- Inflammation sets in, which further impairs breathing

Symptoms
- Shortness of breath and restlessness
- Chest pain
- Copious blood tinged sputum
- Tachycardia, tachypnea, dyspnea, and cyanosis

Smoke Inhalation

- Leading cause of death in burn injury
- Common when a burn occurs in a closed space
- Suspected with burns of the face and upper torso
- Burns airways; carbon monoxide or cyanide poisoning
- Lung damage from noxious gases

Smoke Inhalation

- Manifestations
  - Dyspnea
  - Wheezes
  - Ash-like material in sputum
  - Carbon monoxide poisoning
  - Bronchospasm
  - Edema
**Near-Drowning**

- Aspiration and oxygen deprivation
  - Immersion of 3–5 minutes can cause significant hypoxemia and loss of consciousness
  - Death occurs within 5–10 minutes
  - Very cold water may prolong survival
  - Aspirates fresh or saltwater; causes pulmonary edema and respiratory failure

**Manifestations**

- Altered consciousness
- Restlessness
- Apprehension
- Hypothermia
- Other signs
- Shock and cardiac arrest
Chest and Lung Trauma

- **Diagnostic Tests**
  - Serum electrolytes and ABGs
  - Carboxyhemoglogin
  - Chest x-ray
  - Bronchoscopy

- **Treatment**
  - Analgesia
  - Intercostals nerve block
  - CPR for drowning victim

- **Nursing care**
  - Impaired Airway Clearance
  - Impaired Gas Exchange
  - Pain
  - Ineffective Tissue Perfusion: Cerebral
Chest and Lung Trauma

- Continuing care
- Prevention
  - Seat belts
  - Smoke detectors
  - Life preservers and flotation vests
  - Avoid alcohol
  - Know CPR

Respiratory Failure

- Lungs unable to oxygenate blood and remove carbon dioxide
- COPD is usual cause
- Other diseases include trauma, neuromuscular disorders, and heart disease

Respiratory Failure

- Pathophysiology
  - Blood oxygen levels are low: $PO_2 < 50$–$60$ mm Hg
  - Carbon dioxide levels rise
  - Tissue hypoxia
  - Acidosis
Acute Respiratory Distress Syndrome (ARDS)

- Noncardiac pulmonary edema and progressive hypoxemia that does not respond to oxygen therapy
- Direct lung injury
  - Smoke inhalation
  - Near-drowning
- Indirect lung injury
  - Shock
  - Sepsis

ARDS - Pathophysiology

- Massive unregulated systemic inflammatory response
- Lung damage occurs rapidly within 24 hours
- Alveolar-capillary membrane allow plasma and blood cells to leak into interstitial space and alveoli
- Alveolar surfactant is inactivated; cells that produce surfactant are damaged
- Alveolar collapse
- Work of breathing increases and gas exchange is impaired
- Hypoxemia develops

Critical Respiratory Conditions

- Treatment is the same for both respiratory failure and ARDS
- Diagnostic tests
  - ABGs
  - Chest x-ray
  - Ventilation perfusion scan
  - Exhaled carbon dioxide (ETCO₂)
Critical Respiratory Conditions - Treatment

- Medications
  - Bronchodilators
  - Corticosteroids
  - NSAIDs
  - Surfactant
  - Sedation during ventilation

Critical Respiratory Conditions - Treatment

- Oxygen therapy
  - COPD clients—1 to 3 liters by nasal cannula
  - Avoid high flow rates to prevent oxygen toxicity
  - Continuous positive airway pressure (CPAP)

Critical Respiratory Conditions - Treatment

- Airway management
  - Endotracheal tube
  - Tracheostomy
  - Nasogastric and feeding tubes
Mechanical Ventilation

- Positive pressure ventilators
- Types
- Modes
- Settings
  - Rate
  - Tidal volume
  - Oxygen percentage
  - Positive end expiratory pressure (PEEP)

TABLE 24-11 Modes of Ventilator Operation

<table>
<thead>
<tr>
<th>Mode of Ventilator Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assist control</td>
<td>Client controls respiratory rate, inspiratory time, and inspiratory flow rate.</td>
</tr>
<tr>
<td>Pressure support (PSV)</td>
<td>Pressures are set to maintain minute ventilation, spontaneous breathing, and潮气量.</td>
</tr>
<tr>
<td>Pressure control (PCV)</td>
<td>Pressure support and mandatory ventilation.</td>
</tr>
<tr>
<td>Conventional ventilation</td>
<td>Matched to the patient's spontaneous breathing.</td>
</tr>
<tr>
<td>Pressure regulated (PRVC)</td>
<td>Used in conjunction with other ventilator modes to provide ventilation support.</td>
</tr>
<tr>
<td>Pressure support (PSV)</td>
<td>Pressure support and mandatory ventilation.</td>
</tr>
</tbody>
</table>

Mechanical Ventilation

- Complications
  - Pressure necrosis of nose, lip, trachea
  - Less saliva is produced
  - Dislodgement of tube
  - Infection
  - Barotraumas
Critical Respiratory Conditions

- Weaning processes
  - Terminal weaning
- Other therapies
  - Pulmonary artery catheter
  - Fluid replacement

ARDS – Nursing Care

- Assessment and monitoring frequently
- Impaired Spontaneous Ventilation
- Ineffective Airway Clearance
- Risk for Injury
- Decreased Cardiac Output
- Anxiety