Management of Patients With Chest and Lower Respiratory Tract Disorders

By

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Learning Objectives

On completion of this chapter, the students will be able to:

1. Relate pleural effusion to pulmonary infection.
2. Describe risk factors for measures appropriate for prevention & management of pulmonary embolism.
3. Discuss the modes of therapy and related nursing management for patients with lung cancer.
4. Describe the complications of chest trauma & their clinical manifestations and nursing management.

Pulmonary Tuberculosis

- Tuberculosis (TB) is an infectious disease that primarily affects the lung parenchyma.
- It also may be transmitted to other parts of the body, including the meninges, kidneys, bones, and lymph nodes.
- The primary infectious agent, *Mycobacterium tuberculosis,*is an acid-fast aerobic rod that grows slowly & is sensitive to heat & ultraviolet light.
- *Mycobacterium bovis and Mycobacterium avium have rarely been associated with the development* of a TB infection.
- TB is a worldwide public health problem, & the mortality & morbidity rates continue to rise.
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Pulmonary Tuberculosis

- *M. tuberculosis infects an estimated* one third of the world's population & remains the leading cause of death from infectious disease in the world.
- It is the leading cause of death among HIV-positive people.
- TB is closely associated with poverty, malnutrition, overcrowding, substandard housing, and inadequate health care.

Transmission and Risk Factors

- TB spreads from person to person by airborne transmission.
- An infected person releases droplet through talking, coughing, sneezing, laughing, or singing.
- Close contact with someone who has active TB.
- Immunocompromised status (e.g. those with HIV infection, cancer, transplanted organs, and prolonged high-dose corticosteroid therapy)
- Substance abuse (IV or injection drug users and alcoholics)
- Any person without adequate health care (the homeless; impoverished; children under age 15 years and young adults between ages 15 and 44 yrs).
- Preexisting medical conditions or special treatment (e.g. diabetes, chronic renal failure, malnourishment)

Transmission and Risk Factors

- Immigration from countries with a high prevalence of TB (southeastern Asia, Africa, Latin America, Caribbean)
- Institutionalization (e.g. long-term care facilities, psychiatric institutions, prisons)
- Living in overcrowded, substandard housing
- Being a health care worker performing high-risk activities: administration of aerosolized medications, sputum induction procedures, bronchoscopy, suctioning, coughing procedures, caring for the immunosuppressed patient, home care with the high-risk population, and administering anesthesia and related procedures (e.g. intubation, suctioning)

Clinical Manifestations

- Most patients have a low-grade fever, cough, night sweats, fatigue, and weight loss.
- The cough may be nonproductive, or mucopurulent sputum may be expectorated.
- Hemoptysis also may occur.
- Both the systemic and pulmonary symptoms are usually chronic and may have been present for weeks to months.
- The elderly usually present with less pronounced symptoms than do younger patients.
- Extra pulmonary disease occurs in up to 16% of cases in the United States.

Assessment and Diagnostic Findings

- Tuberculin skin test: purified protein derivative (PPD), is injected into the intradermal layer of the inner aspect of the forearm, 4 inches below the elbow, approximately 0.1 ml of PPD is injected, creating an elevation in the skin, a wheal or bleb.
- The site, antigen name, date, and time of the test are recorded.
- The test result is read 48 to 72 hours after injection. Tests read after 72 hours tend to underestimate the true size of **induration (hardening).**
- A delayed localized reaction indicates that the person is sensitive to tuberculin.

Assessment and Diagnostic Findings

- A reaction occurs when both induration and erythema (redness) are noted.
- Erythema without induration is not considered significant.
- A reaction of 0 to 4 mm is considered not significant; a reaction of 5 mm or greater may be significant in individuals who are considered at risk.
- An induration of 10 mm or greater is usually considered significant in individuals who have normal or mildly impaired immunity.

Assessment and Diagnostic Findings

- A significant reaction indicates that a patient has been exposed to *M. tuberculosis recently or in the past or has been vaccinated* with bacille Calmette-Guerin (BCG) vaccine.
- The BCG vaccine is given to produce a greater resistance to developing TB.
- A reaction of 5 mm or greater is defined as positive for patients who are HIV-positive or have HIV risk factors and are of unknown HIV status, those who are close contacts with an active case, and those who have chest x-ray results consistent with tuberculosis.

Classification of TB

- Data from the history, physical examination, skin test, chest x-ray, & microbiologic studies are used to classify TB into one of five classes.
  - Class 0: no exposure; no infection
  - Class 1: exposure; no evidence of infection
  - Class 2: latent infection; no disease (e.g. positive PPD reaction but no clinical evidence of active TB)
  - Class 3: disease; clinically active
  - Class 4: disease; not clinically active
  - Class 5: suspected disease; diagnosis pending

Medical Management

- Pulmonary TB is treated primarily with chemotherapeutic agents (antituberculosis agents) for 6 to 12 months.
- A prolonged treatment duration is necessary to ensure eradication of the organisms and to prevent relapse.
- In current TB therapy, five first-line medications are used: INH, rifampin, pyrazinamide, and either streptomycin or ethambutol daily for 8 weeks.
- The medication regimen, however, may continue for 12 months.
- A person is considered noninfectious after 2 to 3 weeks of continuous medication therapy.
- Vitamin B (pyridoxine) is usually administered with INH to prevent INH-associated peripheral neuropathy

NURSING PROCESS: THE PATIENT WITH TUBERCULOSIS

Assessment

- The nurse performs a complete history and physical examination.

Nursing Diagnoses

- Based on the assessment data, the nursing diagnoses may include:
  - Ineffective airway clearance related to copious tracheobronchial secretions
  - Deficient knowledge about treatment regimen and preventive health measures and related ineffective individual management of the therapeutic regimen (noncompliance)
  - Activity intolerance related to fatigue, altered nutritional status, and fever

Potential Complications

- Malnutrition
- Adverse side effects of medication therapy: hepatitis, neurologic changes (deafness or neuritis), skin rash, gastrointestinal upset
- Multidrug resistance
- Spread of TB infection (miliary TB)

NURSING PROCESS: THE PATIENT WITH TUBERCULOSIS

Planning and Goals

- The major goals for the patient include maintenance of a patent airway, increased knowledge about the disease and treatment regimen and adherence to the medication regimen, increased activity tolerance, and absence of complications.

Nursing Interventions

1- Promoting airway clearance

2- Advocating adherence to treatment regimen

3- Promoting activity and adequate nutrition

4- Monitoring and managing potential complications

5- Promoting home and community-based care

NURSING PROCESS: THE PATIENT WITH TUBERCULOSIS

Evaluation

Expected patient outcomes may include:

1. Maintains a patent airway by managing secretions with hydration, humidification, coughing, and postural drainage
2. Demonstrates an adequate level of knowledge
   a. Lists medications by name and the correct schedule for taking them
   b. Names expected side effects of medications
   c. Identifies how and when to contact health care provider
3. Adheres to treatment regimen by taking medications as prescribed and reporting for follow-up screening
4. Maintains activity schedule

5. Participates in preventive measures

a. Disposes of used tissues properly

b. Encourages people who are close contacts to report for testing

c. Adheres to hand hygiene recommendations

6. Exhibits no complications

a. Maintains adequate weight or gains weight if indicated

b. Exhibits normal results of tests of liver and kidney function

7. Takes steps to minimize side effects of medications

a. Takes supplemental vitamins (vitamin B), as prescribed, to minimize peripheral neuropathy b. Avoids use of alcohol

c. Avoids foods containing tyramine and histamine

d. Has regular physical examinations and blood tests to evaluate liver & kidney function, neuropathy, hearing & visual acuity

Pleural Effusion

- Pleural effusion, a collection of fluid in the pleural space, is rarely a primary disease process but is usually secondary to other diseases.
- Normally, the pleural space contains a small amount of fluid (5 to 15 ml), which acts as a lubricant that allows the pleural surfaces to move without friction.
- Pleural effusion may be a complication of heart failure, TB, pneumonia, pulmonary infections (particularly viral infections), nephrotic syndrome, connective tissue disease, pulmonary embolism, and neoplastic tumors.
- Bronchogenic carcinoma is the most common malignancy associated with a pleural effusion.

Clinical Manifestations

- Usually the clinical manifestations are those caused by the underlying disease.
- Pneumonia causes fever, chills, and pleuritic chest pain, whereas a malignant effusion may result in dyspnea and coughing.
- The size of the effusion and the patient's underlying lung disease determine the severity of symptoms.
- A large pleural effusion causes shortness of breath.
- When a small to moderate pleural effusion is present, dyspnea may be absent or only minimal.

Assessment and Diagnostic Findings

- Physical examination, chest x-ray, chest CT scan, & thoracentesis confirm the presence of fluid.
- In some instances, a lateral decubitus x-ray is obtained. For this x-ray, the patient lies on the affected side in a side-lying position.
- Pleural fluid is analyzed by bacterial culture, Gram stain, acid fast bacillus stain (for TB), red and WBC counts, chemistry studies (glucose, amylase, lactic dehydrogenase, protein), cytologic analysis for malignant cells, and pH.
- A pleural biopsy also may be performed.

Medical Management

- The objectives of treatment are to discover the underlying cause, to prevent reaccumulation of fluid, and to relieve discomfort, dyspnea, and respiratory compromise.
- Specific treatment is directed at the underlying cause (e.g. heart failure, pneumonia, lung cancer, cirrhosis).
- If the pleural fluid is an exudates, more extensive diagnostic procedures are performed to determine the cause.
- Treatment for the primary cause is then instituted.
- Thoracentesis is performed to remove fluid, to obtain a specimen for analysis, and to relieve dyspnea and respiratory compromise.

Medical Management

- Depending on the size of the pleural effusion, the patient may be treated by removing the fluid during the thoracentesis procedure or by inserting a chest tube connected to a water-seal drainage system or suction to evacuate the pleural space & re-expand the lung.
- If the underlying cause is a malignancy, however, the effusion tends to recur within a few days or weeks.
- Other treatments for malignant pleural effusions include surgical pleurectomy, insertion of a small catheter attached to a drainage bottle for outpatient management, or implantation of a pleuroperitoneal shunt.

Medical Management

- A pleuroperitoneal shunt consists of two catheters connected by a pump chamber containing two one-way valves. Fluid moves from the pleural space to the pump chamber and then to the peritoneal cavity.
- The patient manually pumps on the reservoir daily to move fluid from the pleural space to the peritoneal space

Nursing Management

- The nurse's role in the care of the patient with a pleural effusion includes implementing the medical regimen.
- The nurse prepares & positions the patient for thoracentesis & offers support throughout the procedure.
- Pain management is a priority, and the nurse assists the patient to assume positions that are the least painful. However, frequent turning and ambulation are important to facilitate drainage.
- The nurse administers analgesics as prescribed and as needed.
- If the patient is to be managed as an outpatient with a pleural catheter for drainage, the nurse is responsible for educating the patient & family regarding management & care of the catheter & drainage system.

Acute Respiratory Failure

- Respiratory failure is a sudden and life-threatening deterioration of the gas exchange function of the lung. It exists when the exchange of oxygen for carbon dioxide in the lungs cannot keep up with the rate of oxygen consumption and carbon dioxide production by the cells of the body.
- Acute respiratory failure (ARF) is defined as a fall in arterial oxygen tension (PaO_2) to less than 50 mm Hg (hypoxemia) & a rise in arterial carbon dioxide tension ($PaCO_2$) to greater than 50 mm Hg (hypercapnia), with an arterial pH of less than 7.35.
- In ARF, the ventilation or perfusion mechanisms in the lung are impaired. Respiratory system mechanisms leading to ARF include: • Alveolar hypoventilation • Diffusion abnormalities • Ventilation–perfusion mismatching • Shunting

Acute Respiratory Failure

- It is important to distinguish between ARF and chronic respiratory failure.
- Chronic respiratory failure is defined as a deterioration in the gas exchange function of the lung that has developed insidiously or has persisted for a long period after an episode of ARF.
- The absence of acute symptoms and the presence of a chronic respiratory acidosis suggest the chronicity of the respiratory failure.
- Two causes of chronic respiratory failure are COPD and neuromuscular diseases

Clinical Manifestations

- Early signs are those associated with impaired oxygenation & may include restlessness, fatigue, headache, dyspnea, air hunger, tachycardia, and increased blood pressure.
- As the hypoxemia progresses, more obvious signs may be present, including confusion, lethargy, tachycardia, tachypnea, central cyanosis, diaphoresis, and finally respiratory arrest.
- Physical findings are those of acute respiratory distress, including use of accessory muscles, decreased breath sounds if the patient cannot adequately ventilate, and other findings related specifically to the underlying disease process and cause of ARF.

Medical Management

- The objectives of treatment are to correct the underlying cause and to restore adequate gas exchange in the lung.
- Intubation and mechanical ventilation may be required to maintain adequate ventilation and oxygenation while the underlying cause is corrected.

Nursing Management

- Assisting with intubation and maintaining mechanical ventilation
- Assesses the patient's respiratory status by monitoring the patient's level of response, arterial blood gases, pulse oximetry, and vital signs and assessing the respiratory system.
- Implements strategies (e.g. turning schedule, mouth care, skin care, range of motion of extremities) to prevent complications.
- Assesses the patient's understanding of the management strategies that are used and initiates some form of communication to enable the patient to express his or her needs to the health care team.
- Assesses the patient's knowledge of the underlying disorder and provides teaching as appropriate to address the underlying disorder.

Pulmonary Embolism

- **Pulmonary embolism (PE) refers to the obstruction of the pulmonary** artery or one of its branches by a thrombus that originates somewhere in the venous system or in the right side of the heart.
- Most commonly, PE is due to a blood clot or thrombus. However, there are other types of emboli: air, fat, amniotic fluid, and septic (from bacterial invasion of the thrombus).
- PE is a common disorder & often is associated with trauma, surgery (orthopedic, major abdominal, pelvic, gynecologic), pregnancy, heart failure, age older than 50 years, hypercoagulable states, and prolonged immobility.

Pulmonary Embolism

- Although most thrombi originate in the deep veins of the legs, other sites include the pelvic veins and the right atrium of the heart.
- A venous thrombosis can result from slowing of blood flow (stasis), secondary to damage to the blood vessel wall (particularly the endothelial lining) or changes in the blood coagulation mechanism.
- Atrial fibrillation is also a cause of pulmonary embolism.
- An enlarged right atrium in fibrillation causes blood to stagnate and form clots in this area.
- These clots are prone to travel into the pulmonary circulation.

Clinical Manifestations

- The symptoms of PE depend on the size of the thrombus and the area of the pulmonary artery occluded by the thrombus; they may be nonspecific.
- Dyspnea is the most frequent symptom; tachypnea is the most frequent sign. The duration and intensity of the dyspnea depend on the extent of embolization.
- Chest pain is common and is usually sudden and pleuritic. It may be substernal and mimic angina pectoris or a myocardial infarction.
- Other symptoms include anxiety, fever, tachycardia, apprehension, cough, diaphoresis, hemoptysis, and syncope.

Assessment and Diagnostic Findings

- Death from PE commonly occurs within 1 hour of symptoms; thus, early recognition and diagnosis are priorities.
- The diagnostic workup includes a ventilation–perfusion scan, pulmonary angiography, chest x-ray, ECG, peripheral vascular studies, and arterial blood gas analysis.

Prevention

- For those at risk, the most effective approach to preventing PE is to prevent deep venous thrombosis. Active leg exercises to avoid venous stasis, early ambulation, and use of elastic compression stockings are general preventive measures.

Medical Management

- Because PE is often a medical emergency, emergency management is of primary concern. After emergency measures have been taken and the patient's condition stabilizes, the treatment goal is to dissolve (lyse) the existing emboli and prevent new ones from forming.
- The treatment of PE may include a variety of modalities:
  - General measures to improve respiratory and vascular status
  - Anticoagulation therapy
  - Thrombolytic therapy
  - Surgical intervention

Emergency management

- Nasal oxygen is administered immediately to relieve hypoxemia, respiratory distress, and central cyanosis.
- Intravenous infusion lines are started to establish routes for medications or fluids that will be needed.
- A perfusion scan, hemodynamic measurements, and arterial blood gas determinations are performed.
- Spiral (helical) CT or pulmonary angiography may be performed.
- Hypotension is treated by a slow infusion of dobutamine (Dobutrex) (which has a dilating effect on the pulmonary vessels and bronchi) or dopamine
- The ECG is monitored continuously for dysrhythmias and right ventricular failure, which may occur suddenly.

Emergency management

- Digitalis glycosides, intravenous diuretics, and antiarrhythmic agents are administered when appropriate.
- Blood is drawn for serum electrolytes, complete blood count, and hematocrit.
- If clinical assessment and arterial blood gas analysis indicate the need, the patient is intubated and placed on a mechanical ventilator.
- If the patient has suffered massive embolism and is hypotensive, an indwelling urinary catheter is inserted to monitor urinary output.
- Small doses of intravenous morphine or sedatives are administered to relieve the patient's anxiety, to alleviate chest discomfort, to improve tolerance of the endotracheal tube, and to ease adaptation to the mechanical ventilator.

General management

- Measures are initiated to improve the patient's respiratory and vascular status.
- Oxygen therapy is administered to correct the hypoxemia, relieve the pulmonary vascular vasoconstriction, and reduce the pulmonary hypertension.
- Using elastic compression stockings or intermittent pneumatic leg compression devices reduces venous stasis.
- These measures compress the superficial veins and increase the velocity of blood in the deep veins by redirecting the blood through the deep veins.
- Elevating the leg (above the level of the heart) also increases venous flow.

Pharmacologic therapy

Anticoagulation Therapy:

- Heparin is used to prevent recurrence of emboli but has no effect on emboli that are already present. It is administered as an intravenous bolus of 5,000 to 10,000 units, followed by a continuous infusion initiated at a dose of 18 U/kg per hour. Heparin is usually administered for 5 to 7 days.
- Warfarin sodium (Coumadin) administration is begun within 24 hours after the start of heparin therapy because its onset of action is 4 to 5 days. Warfarin is usually continue for 3 to 6 months.

Thrombolytic Therapy:

- Thrombolytic therapy resolves thrombi or emboli more quickly and restores more normal hemodynamic functioning of the pulmonary circulation, thereby reducing pulmonary hypertension

Pharmacologic therapy

Thrombolytic Therapy:

- and improving perfusion, oxygenation, and Heparin is stopped prior to administration of a thrombolytic agent.

- After the thrombolytic infusion is completed (which varies in duration according to the agent used and the condition being treated), the patient is given anticoagulants.

Surgical management

- A surgical embolectomy is rarely performed but may be indicated if the patient has a massive PE or hemodynamic instability or if there are contraindications to thrombolytic therapy.

The End