

## Pulmonary Tuberculosis Study Notes

Pulmonary tuberculosis is an acute or chronic lung infection caused by *Mycobacterium tuberculosis*. It is characterized by pulmonary infiltrates and the formation of granulomas with caseation, fibrosis, and cavitation.

### Pathophysiology

- Transmission occurs via airborne droplet nuclei when a person with active disease coughs or sneezes.
- Inhaled mycobacterium bacilli travel to the alveoli where they are ingested by macrophages.
- Multiplication of *M. tuberculosis* bacilli initiates an inflammatory process in the lungs.
  - A cell-mediated immune response occurs, usually containing the infection in 2 to 8 weeks.
  - The T-cell response results in the formation of granulomas around the bacilli, making them dormant. This confers immunity to subsequent infection.
- Bacilli within granulomas may remain viable for many years.
- Active disease develops in 5% to 10% of those infected.

### Causes

- Exposure to *M. tuberculosis*
- Exposure to strains of mycobacteria other than TB (not contagious)

### Risk Factors

- Close contact with a patient with TB who has active disease
- History of prior TB exposure
- High-risk behaviors (such as drug use and multiple sex partners)
- Recent immigration from high-incidence areas
- Gastrectomy
- History of silicosis, diabetes, malnutrition, cancer, Hodgkin disease, or leukemia
- Drug and alcohol abuse
- Residence in congregated settings, such as a shelter, an extended-care facility, a mental health facility, or a prison
- Immunosuppression, such as from the human immunodeficiency virus (HIV) infection, and the use of corticosteroids
- Homelessness

### Incidence

- TB is the most common cause of infectious disease-related mortality worldwide.
- The overall incidence of TB has decreased but is greater among high-risk populations.

- Forty percent of HIV deaths are attributed to TB.

## Complications

- Massive pulmonary tissue damage
- Respiratory failure
- Bronchopleural fistulas
- Bronchiectasis
- Hemoptysis
- Pneumothorax
- Pleural effusion
- Pneumonia
- Infection of other body organs by small mycobacterial foci
- Liver disease secondary to drug therapy
- Ototoxicity and retinal toxicity secondary to drug therapy

## Assessment

### History

### Primary infection

- May be asymptomatic after a 4- to 8-week incubation period
- Cough
- Weakness and fatigue
- Anorexia, weight loss
- Low-grade fever
- Night sweats
- Chest pain; pleuritic chest pain
- Hemoptysis

### Reactivated infection

- Chest pain
- Nonproductive or productive cough containing blood or mucopurulent or blood-tinged sputum
- Low-grade fever
- Dyspnea
- Weight loss

### Physical Findings

- Cough
- Fever
- Anorexia, weight loss
- Dullness over the affected area

- Crepitant crackles
- Bronchial breath sounds
- Wheezes
- Whispered pectoriloquy
- Lymphadenopathy (bilateral), primarily of the posterior cervical chain or supraclavicular nodes

## Extrapulmonary TB

- Based on tissues involved
- Confusion
- Neurologic impairment
- Enlarged lymph nodes
- Cutaneous lesions
- Back pain, arthritis pain (of one joint) or lower extremity paralysis (skeletal TB)
- Flank pain, dysuria (genitourinary TB)
- Difficulty swallowing, diarrhea, nonhealing ulcers of the mouth or anus (gastrointestinal TB)

## Diagnostic Test Results

### Laboratory

- Tuberculin skin tests are positive in active and inactive (latent) TB.
- T-SPOT TB test identifies interferon-gamma response to specific *M. tuberculosis* proteins to detect infection.
- QuantiFERON-TB gold test or interferon gamma release assay detects latent TB infection.
- Nucleic acid amplification tests detect TB complex DNA and common mutations associated with drug resistance.
- Stains and cultures of sputum, cerebrospinal fluid, urine, abscess drainage, or pleural fluid show heat-sensitive, nonmotile, aerobic, acid-fast bacilli.
- Urinalysis and urine cultures are performed if genitourinary symptoms are present.

### Imaging

- Chest radiography shows nodular lesions, patchy infiltrates, cavity formation, scar tissue, and calcium deposits—common findings in primary infection.
- Computed tomography scanning (thorax) or magnetic resonance imaging shows the presence and extent of lung damage or evaluates vertebral or brain involvement with extrapulmonary TB.

## Diagnostic Procedures

- Bronchoscopy specimens show heat-sensitive, nonmotile, aerobic, acid-fast bacilli.
- Biopsy for extrapulmonary TB is performed based on symptoms.

## Treatment

## General

- When the disease is no longer infectious (in 2 to 4 weeks), resumption of normal activities while continuing to take medication
- Airborne precautions (private room with negative pressure airflow; N95 or N100 efficiency masks on caregivers or visitors)
- Smoking cessation
- Venous thromboembolism (VTE) prophylaxis if hospitalized

## Activity

- Rest initially, followed by activity as tolerated

## Medications

- Antitubercular therapy options for drug-susceptible disease:
  - 6- to 9-month treatment regimen with isoniazid, rifAMPin (rifampicin), ethambutol hydrochloride, and pyrazinamide
  - 4-month treatment regimen with high-dose rifapentine, moxifloxacin hydrochloride, isoniazid, and pyrazinamide (an option for certain patients age 12 years or older with a body weight of at least 40 kg, including patients with HIV who are on an efavirenz-based regimen and have a CD4 cell count greater than 100 cells/microliter)
- Antitubercular therapy options for drug-resistant disease (regimens should include only drugs to which the patient's TB isolate has documented or high likelihood of susceptibility):
  - Bedaquiline fumarate
  - CycloSERINE
  - Clofazimine
  - Fluoroquinolones, such as levoFLOXacin or moxifloxacin hydrochloride
  - Linezolid
  - Aminoglycosides, such as streptomycin sulfate or amikacin sulfate
  - Ethambutol hydrochloride
  - Pyrazinamide
  - Carbapenems, such as imipenem–cilastatin sodium or meropenem, plus clavulanate
  - Pretomanid

## Surgery

- Lobectomy or pneumonectomy for patients with multidrug-resistant TB and poor medical treatment prognosis

## Nursing Considerations

## Nursing Interventions

- Administer drug therapy, as prescribed; give isoniazid on an empty stomach 1 hour before or 2 hours after meals.
- Isolate the patient in a negative pressure airflow room.
- Institute airborne precautions for pulmonary TB until the patient has at least three consecutive negative sputum cultures; institute airborne and contact precautions for extrapulmonary TB with draining lesions until drainage has stopped and the patient has three consecutive negative sputum cultures.
- Provide diversional activities.
- Properly dispose of secretions; encourage respiratory hygiene measures.
- Provide adequate rest. Cluster care activities to provide for uninterrupted periods of rest.
- Apply antiembolism stockings or sequential compression stockings to prevent VTE.
- Provide well-balanced, high-calorie foods.
- Provide small, frequent meals.
- Consult with a dietitian if oral supplements are needed.
- Perform chest physiotherapy. Encourage frequent coughing and deep-breathing exercises.
- Provide supportive care:
  - Encourage the patient to verbalize concerns and fears.
  - Answer questions honestly.
  - Provide clear explanations about procedures and care measures.
- Include the patient in care decisions.
- Obtain specimens for laboratory testing, such as sputum cultures, as indicated.
- Notify the local health department if required by state regulations.

## Monitoring

- Vital signs
- Intake and output
- Respiratory status, including airway patency and sputum production
- Daily weight
- Complications
- Adverse reactions
- Visual acuity if taking ethambutol
- Liver and kidney function tests
- Pain level and effectiveness of interventions

## Associated Nursing Procedures

- Airborne precautions
- Antiembolism stocking application, knee-length
- Antiembolism stocking application, thigh-length
- Chest physiotherapy
- Contact precautions
- Incentive spirometry
- Intake and output measurement
- Nutritional screening
- Oral drug administration
- Pain assessment
- Pain management

- Personal protective equipment (PPE), putting on
- Personal protective equipment (PPE), removal
- Safe medication administration practices, general
- Sequential compression therapy
- Sputum collection by expectoration
- Sputum collection by tracheal suctioning
- Tuberculin skin testing
- Weight measurement

## Patient Teaching

### General

Include the patient's family or caregiver in your teaching, when appropriate. Provide information according to their individual communication and learning needs. Be sure to cover:

- disorder, diagnostic testing, and treatment, including the duration of prescribed medication therapy
- possible exposure of family members and the need for testing and possible treatment
- drugs and potential adverse effects, including the importance of adhering to the regimen to ensure eradication of the infection
- signs and symptoms of recurrence and complications, including when to notify the physician
- appropriate infection control precautions and respiratory hygiene measures
- postural drainage and chest percussion
- coughing and diaphragmatic breathing exercises
- importance of regular follow-up examinations, including weekly sputum analysis until a negative result occurs; periodic laboratory testing of blood count, liver enzymes, and serum creatinine level; and periodic serum uric acid testing if the patient is taking pyrazinamide
- possibility of decreased hormonal contraceptive effectiveness while taking rifAMPin (rifampicin)
- possibility of permanent staining of contact lenses with rifAMPin (rifampicin)
- need for a high-calorie, high-protein, balanced diet
- measures to prevent TB and its transmission.

#### tuberculosis

Explain airborne and standard precautions to a hospitalized patient with tuberculosis. Before discharge, tell the patient that precautions to prevent spreading the disease, such as wearing a mask around others, should be taken until the physician reports that the infection is no longer contagious. The patient should tell all health care practitioners, including dentists and optometrists, about the diagnosis of tuberculosis so that they can institute infection-control precautions.

Teach the patient other specific precautions to take to avoid spreading the infection. Tell the

patient to cough and sneeze into tissues and to dispose of the tissues properly. Stress the importance of performing hand hygiene with hot, soapy water after handling secretions. Also instruct the patient to wash all eating utensils separately in hot, soapy water.

## Discharge Planning

- Participate as part of a multidisciplinary team to coordinate discharge planning efforts. The team may include a bedside nurse, care manager, nutritionist, physical therapist, respiratory therapist, pulmonologist, and primary care practitioner.
- Assess the patient's and family's understanding of the diagnosis, treatment, follow-up, and warning signs for which to seek medical attention.
- Assess the patient's level of independence before admission.
- Evaluate how the current illness will affect the patient's independence.
- Identify the patient's formal and informal supports.
- Identify the patient's and family's goals, preferences, comprehension, and concerns about discharge.
- Confirm arrangements for transportation to initial follow-up appointments.
- Provide a list of prescribed drugs, including the dosage, prescribed time schedule, and adverse reactions to report to the practitioner. Provide the patient (and family or caregiver, as needed) with written information on the medications that the patient should take after discharge.
- Assess the patient's and family's understanding of prescribed medication, including dosage, administration, expected results, duration, and possible adverse effects.
- Assess the patient's ability to obtain medications; identify the party responsible for obtaining medications.
- Instruct the patient to provide a list of medications to the practitioner who will be caring for the patient after discharge; to update the information when the practitioner discontinues medications, changes doses, or adds new medications (including over-the-counter products); and to carry a medication list that contains all of this information at all times in the event of an emergency.
- Assist with arrangement of home health care, if needed.
- Provide information on smoking cessation, if appropriate.
- Ensure that the patient and caregivers receive the proper medical contact information.
- Ensure that the patient or caregiver receives a copy of the discharge instructions and that a copy is placed in the patient's medical record.
- Assess the patient's and family's understanding of teaching by using the teach-back method, when possible.
- Document the discharge planning evaluation in the patient's clinical record, including who was involved in discharge planning and teaching, their understanding of teaching provided, and any need for follow-up teaching.