**Tuberculosis** 1900's TB was leading cause of death in US. After introduction of chemotherapy agents in late 1940's there was a dramatic ↓in the prevalence of TB. Today 10-15 million people are infected with or harbor tubercle bacillus. Most have healed or dormant TB. There are about 15,000 cases of active TB diagnosed in the US each year. It was thought that TB would be eliminated in the U.S. by the 21st century, but **since 1985 the declining trend has reversed.**

**Factors for Resurgence of TB**

Emergence of multi-drug-resistant strains of M. tuberculosis

Epidemic proportions of TB among patients with HIV. **HIV infection is the most important risk factor for the development of TB**

High numbers of immigrants, poverty states, and homeless people.

**Etiology and Pathophysiology**

TB is a communicable disease caused by Mycobacterium tuberculosis. *live on surfaces for weeks!*

It is a slow-growing slender rod shaped acid-fast organism.

TB is spread via airborne droplets from coughing, sneezing or speaking.

Brief exposure rarely causes infection, rather close repeated contact must be made.

Tubercle bacilli that reach the alveoli of the lung are ingested by macrophages, but often survive.

The lower parts of the lungs are usually the site of initial bacterial implantation

Tubercle bacilli multiplying in macrophages cause a chemotactic response that brings additional macrophages into the area, forming an early tubercle.

Characteristic epitheliolid cell granuloma results after the immune system is activated.

The central portion of the lesion undergoes necrosis and is named "caseous necrosis".

Liquefaction continues until the bacilli to spill into a bronchiole and then are disseminated throughout the respiratory system and to other systems

The organisms are transported via the lymph system & bloodstream to the lungs, kidneys, bone, cerebral cortex and adrenals. *(can occur in other areas)*

*Reaches alveoli & is engulfed → gas exchange impaired!*

**TB Healing** of the primary lesion usually takes place by resolution, fibrosis, and calcification.
Granulation tissue surrounding the lesion may become fibrous and form scar tissue.
A Ghon complex is formed consisting of the tubercle and lymph nodes.
The Ghon complex may be seen on x-ray.
When a TB lesion regresses and heals, the infection enters a period in which it may persist without producing a clinical illness.
The infection may develop into clinical disease if the persisting organisms begin to multiply rapidly, or it may remain dormant.
If the initial immune response is inadequate, control of the organisms is not maintained then clinical disease results.
Certain individuals are at higher risk for disease: immunosuppressed, those with chronic diseases.
Dormant but viable organisms persist for years. Reactivation of TB can occur if the defense is mechanism is impaired.

*Cancer, HIV, ↑ steroids*

*Need x-ray instead of PPD. once you test +, will always be +. → looking for active disease vs. healed.*

## Manifestations

Early: usually free of symptoms. Many patients find out because of incidental x-ray.
Systemic manifestations may include: fatigue, malaise, anorexia, weight loss, low-grade fever, night sweats. *→ characteristic of active TB.*
Characteristic pulmonary symptoms: frequent, mucoid or mucopurulent cough, hemoptysis. *(blood in sputum)*
Sometimes TB will demonstrate acute onset with fever, chills, flu-like symptoms, and cough
Immunocompromised Symptoms
These clients often have atypical symptoms. *Don't have immune system to produce those symptoms.*
Secondary opportunistic infections may occur (ie. Pneumocystis carinii – PCP)

**TB S&S –**
fever,
hemoptysis,
night sweats,
wt loss >10 lbs

## Complications of TB

**Miliary TB**
If a necrotic Ghon complex erodes through a blood vessel, large numbers of organisms invade the blood stream to all the body.
The client becomes acutely ill: dyspnea, cyanosis, weight loss, fever, GI disturbances.
Physical findings may include: hepatomegaly, splenomegaly, and generalized lymphadenopathy.
**Pleural Effusion**
This is caused by casseous material eroding into the pleural space.
The casseous triggers an inflammatory response and exudate of protein-rich fluid.
The client has pleuritic pain (pleurisy), and dyspnea.

*– Don't dx TB just by x-ray.*

**TB Pneumonia**
Acute pneumonia may result when large amounts of bacilli are discharged from a lesion into the lung or lymph.
The client will complain of chills, fever, cough, chest pain, and have leukocystosis.
**Other Organ Involvement**
The meninges may be involved: meningitis
Bone and joint, kidneys, adrenal glands, and the genital tract may become infected.

## TB Testing and Diagnostics

False - if body hasn't had time to mount response.

### Mantoux Skin Testing

- PPD- Purified protein derivative is used to detect the delayed hypersensitiviy response.
- A + reaction occurs 3-10 weeks after the initial infection, corresponding to the time needed to mount an immune response.
- Once + always positive.
- The test does not differentiate between dormant, or active TB. → need xray
- TB testing may not work with immunocompromised clients. (no immune response)

### TB Tests Considerations

measuring induration

- 5 mm or>: recent contact with TB; Chest x-ray with fibrotic lesions likely healed TB; known or suspected HIV
- 10 mm or>: as above, other medical risk factors, foreign born in high prevalence area, IV drug uses; poor; close socio-conditions.
- 15 mm or >: all others.
- False -: immunosuppression; overwhelming TB infection; testing too soon after exposure.

**Two-step testing** is recommended for individuals who may have ↓ hypersensitivity, health care workers:

1st test +: consider infected
1st test -: repeat 1-3 weeks later
2nd test +: active or prior infection
2nd test -: consider uninfected

A. **0.1 cc of PPD injection at 15 degree angle**
B. **Create a wheal**
C. **Measurement at 48 hours for *induration***

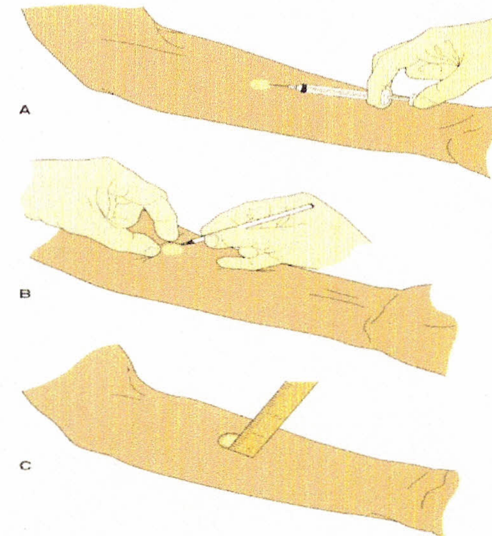


**Figure 34-11** *A.* Intradermal injection for tuberculin testing. *B.* The injection causes a local inflammatory response (wheal). *C.* Measurement of induration following tuberculin testing.

### Chest X-ray

It is not possible to make a diagnosis of TB solely on the mantoux test alone. Other disorders can mimic TB. Multi-nodular lymph node involvement w/cavitations in lungs is seen most "parenchymal lymph node complex". Calcifications many years later may be seen.

### Bacterial Studies

3 (−) AFB sputum to consider patient negative.

Sputum/ CSF or Abscess: tested for acid-fast bacilli is the 1st bacteriologic evidence of TB. Must have > than 10,000 bacteria for test to be +.
Culture of sputum, etc.: Takes 6-8 weeks to grow mycobacterium to grow, but can detect small amounts.
ELISA: enzyme-linked immunosorbent assay: measures IgG antibody against mycobacterial antigen using DNA polymerase chain reaction.

HIV patients

Best time to collect = early A.M.

## Care of the Client With TB

**Drugs**

Aggressive management is needed today with at least two medications to prevent drug resistance.

The five primary drugs include: isoniazid, rifampin, pyrazidnamide, rifabutin and ethambutol.

Other drugs are primarily used for treatment of resistant strains or if the patient develops toxicity to the primary drugs.

Second-line drugs carry a higher risk of toxicity.

**Noncompliance is a major problem in therapy**

This is one reason for multi-drug resistance.

Many people chose not to take the medications secondary to side effects of the medications and cost.

In the non-compliant: DOT "direct observed therapy" may be prescribed. The nurse goes to the home and observes the client taking the medication

**Side Effects of Medications**

Isoniazide (INH), rifampin and pyrazinamide: hepatitis. LFT monitored Q3months.

INH- neurotoxic side effects (numbness, tingling), B6 neuritis, hypersensitivity: rash, arthralgia, fever

Ethambutol: optic neuritis (visual loss), GI upset, nephorotoxicity

**Prophylactic Treatment**

Given to prevent a TB infection from developing into a clinical disease.

The following may receive prophylaxis:

Newly infected, known or suspected HIV and + TB tests

Close exposure to newly diagnosed patient.

Significant TB tests in special groups: DM, silicosis, gastrectomy, ESRD

TB tests>10 mm age less than 35 years; > 15 mm increase for those > 35 years;

all children less than 2 years old with a > 10 mm skin test.

**Vaccine**

BCG (bacille Calmette-Guerin) is live TB is given in foreign countries.

It will cause an uninfected person to convert to +TB test.

Only given with negative TB test, and for isoniazide chemoprophylaxis cannot be used.

Only recommended for clients working in countries with high prevalence

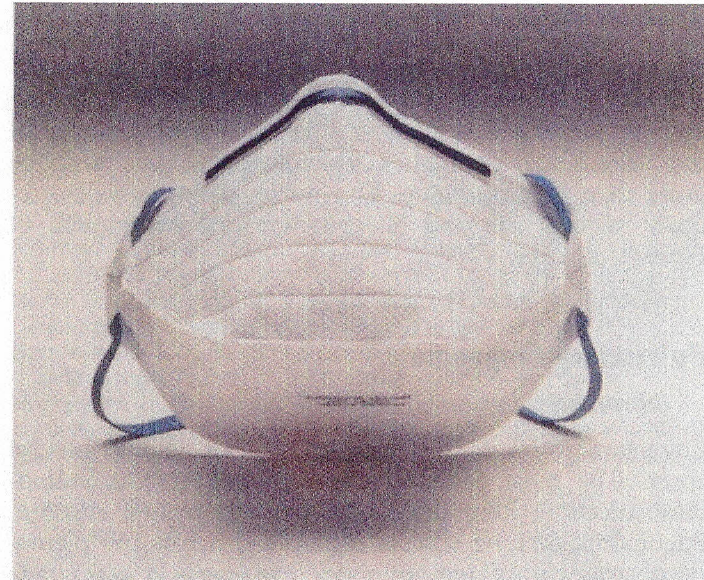

**Figure 33–2.** A HEPA respirator used in the care of clients with active or "rule-out" tuberculosis. (Courtesy of Uvex Safety, Smithfield, RI.)

**Nursing Care**

In acutely infected pts where TB is a R/O diagnosis, nurses must wear a HEPA respirator during all contact.

Gowns and gloves if exposure is expected, or for standard precautions.

The client must be isolated in a filtered air room.

Diet: patients are often nauseated and have no appetite. Increase fluids, and encourage low fat, high protein, and high carbohydrate. Vitamin C foods are encouraged.

Major teaching points: teaching about follow-up, contagion, drugs/ side effects/ compliance, nutrition, labs, eye exams and fatigue/ rest.

Additional medications: antiemetics, anti-tussives, anti-pyretics, Vitamins.

**HEPA Filter Mask**

Must be fitted for correct wearing.

B Scale

## Prevention
PPP
Hepa filter
Isolation in filtered air room
Prophylaxis
Vaccine

## Risk/Resurgence
multi-drug-resistant strains. HIV infection is most important risk factor. High numbers of immigrants, poverty states, and homeless people. Chronic disease.

## MOs
Mycobacterium tuberculosis. Slow-growing slender rod shaped acid-fast organism. TB spread via airborne droplets from coughing, sneezing or speaking. Also on surfaces. Brief exposure rarely causes infection, rather close repeated contact must be made.

## Teach
follow-up
Contagion
drugs/SE
COMPLIANCE
nutrition
Labs
eye exams
fatigue/ rest

# Tuberculosis
Alveoli of lower lobes usually site of initial infxn. Tubercle bacilli are ingested by macrophages, some survive. Tubercle bacilli multiplying in macrophages cause a chemotactic response that brings additional macrophages into the area, forming an early tubercle. Characteristic epitheliolid cell granuloma results after the immune system is activated. Central portion of the lesion undergoes necrosis and is named "caseous necrosis" - necrosis with conversion of damaged tissue into a soft cheesy substance. Liquefaction continues until bacilli spill into a bronchiole and then are disseminated throughout the respiratory system and to other systems via lymph system & bloodstream.

## Treatment
Aggressive management: at least 2 meds.
Five primary are: isoniazid, rifampin, pyrazidnamide, rifabutin and ethambutol.
Other meds primarily used for tx of resistant strains or if pt develops toxicity to primary meds.
Diet
Rest
Add'l meds: antiemetics, anti-tussives, anti-pyretics, Vitamins (esp C)

## Diagnostics
Mantoux skin testing
Testing considerations
Two step testing
CXR
Bacterial - definitive
Need 3 neg sputum

## S&S
FEVER
HEMOPTYSIS
NIGHT SWEATS
WT LOSS >10 LBS
Early symp.
Systemic manifestations
Characteristic pulmonary symp.
Immunocompromised Symp.
Multi-nodular lymph node involvement w/cavitations in lungs is seen most "parenchymal lymph node complex".

## Healing
of the primary lesion usually takes place by resolution, fibrosis, & calcification. Granulation tissue surrounding lesion may become fibrous – scar tissue forms resulting in a Ghon complex consisting of the tubercle and lymph nodes (can be seen on CXR). When a TB lesion regresses and heals, the infection enters a period in which it may persist without producing a clinical illness or it may develop into clinical disease if the organisms begin to multiply rapidly, or it may remain dormant. If the initial immune response is inadequate, control of the organisms is not maintained and clinical disease results. Dormant but viable organisms persist for years. Reactivation of TB can occur if the defense is mechanism is impaired.

## Complications
Miliary TB
Pleural Effusion
TB Pneumonia
Other Organ Involvement