



## **Case Studies: Old Disease, Renewed Threat: Tuberculosis in the Emergency Department**

The number of patients who present to the emergency department with active tuberculosis has increased at an alarming rate. This “old disease” has emerged with drug-resistant strains that are threatening not only the patient but also the emergency department staff. This course details the many manifestations of this disease along with the current treatment recommendations and ideas for prevention.

- Discuss the etiology of the increased incidence of active tuberculosis in the emergency department.
- Describe the drug-resistant strains associated with tuberculosis and the current recommendations for treatment.
- Discuss the role for the BCG vaccine.

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## **FACULTY**

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## Overview

- One billion persons infected worldwide
- 16 million cases and 3 million deaths per year
- 1953 to mid-1980's -- 5% annual decrease in TB cases
- 1984 to 1988 -- Cases leveled off at 22,500 per year
- TB cases then rose with 26,673 cases in 1992
- As of 1992 -- 64,000 excess cases of TB
- 1997 -- Cases decreased to 19,855
- Risk Factors: HIV positive, foreign born (especially Central and South America, Africa, SE Asia, Caribbean), nursing home residents, prisoners, homeless, IVDA

## Transmission

- Infectious droplets of 1-5 microns
- Primary infection -- host defenses stop MTB replication in 2-10 weeks
- Latent period -- CXR without infiltrate, clinically well, not infectious
- Reactivation -- when cell mediated immunity wanes
- Lifetime reactivation risk 5-10%, half of risk is in first 2 years
- Increased risk of reactivation: HIV infection, steroids, chemotherapy, malignancy, renal failure, diabetes, malnutrition, immune suppression
- Increased infectivity: pulmonary/laryngeal TB, active cough, AFB in sputum, cavitation on chest X-ray, on inadequate therapy
- Children overall are less infectious

## Extrapulmonary TB

- 15% of reactivation TB
- Lymph nodes > pleura > kidneys > bones/joints > meninges
- Not infectious unless open skin lesion or oral cavity

## TB and HIV Infection

- HIV large contributor to TB resurgence
- HIV infected are more likely to develop active TB
- Selwyn, et. al. (1989) - PPD positive, HIV positive patients develop active TB up to 8% per year
- Most active TB due to reactivation in HIV positive patients
- Clinical presentation often confusing: negative skin tests, symptoms similar to pneumocystis carinii pneumonia (PCP)

## Diagnostic Studies in AIDS Patients

- Chest X-ray may be atypical in patients with AIDS
- One study: 10% of CXRs normal, 25% lymphadenopathy only, 75% of infiltrates were not upper lobe
- Klein, et. al. (1989) - Decreased sensitivity of AFB stain in HIV patients (AIDS 45% positive, control 81% positive)
- Culture may be less sensitive because mycobacterium avium complex (MAC) co-infection

## Multi-Drug Resistant TB (MDR-TB)

- Resistance to  $\geq 2$  of the 5 primary antituberculous drugs (INH, rifampin, PZA, ethambutol, streptomycin)
- Moore, et. al. (1997) - Survey of TB in US (1993-96) 8.4% INH resistant, 3% rifampin resistant, 2.2% resistant to both
- New York City had 38% of cases
- More resistance if foreign born, HIV positive, or prior TB
- Seven MDR-TB outbreaks between 1990 and 1992
- Mortality 70-90%, median time from diagnosis to death from 4-16 weeks, 17 HCWs or correctional facility workers with active TB
- Telzak, et al. (1995) -- 26 HIV negative patients in NYC with MDR-TB: 96% clinical responses, 100% microbiologic responses
- MDR-TB may be infectious longer if on inadequate regimen
- MDR-TB more likely to have positive APB smears (Bloch, et. al.)

## Threat to ED Personnel

- High risk patient population -- Homeless, foreign born, recently incarcerated, chronically debilitated
- Overcrowding -- extended waiting period and admission delays
- Often inadequate isolation facilities
- Usually no previous diagnosis of TB
- Moran, et. al. (Los Angeles County, 1994) - Mean time from registration to isolation 6.5 hours, 46% first isolated on the ward
- Rao, et al. Median interval from admit to meds 6 days; 75% delay  $\geq 24$  hours
- Parkland Memorial Hospital, 1983 - 15 PPD conversions and 6 cases of active TB in ED employees
- Baseline Parkland PPD conversion rate 3%, 1% per year at UCDMC
- Harbor-UCLA Medical Center, 1993 -- 31% of ED personnel converted PPD during employment (attending 20%, registered nurses 32%, residents 33%)
- PPD conversion risk -- 6% after 1 year, 14% after 2 years, 27% after 4 years

## Assigning Risk to Work Areas

1. High Risk = meets **any** of these criteria
  - PPD conversion rate  $>$  other areas where MTB is unlikely
  - PPD conversion rate  $>$  previous rate for that area
  - Two or more PPD conversions within 3 months
  - Evidence of person to person transmission
2. Intermediate Risk
  - None of the above criteria
  - Sees  $\geq 6$  TB patients per year
3. Low Risk
  - None of the above criteria
  - Sees  $\leq 6$  TB patients per year
4. Very Low Risk = facility does not see TB patients

## Triage Protocols for TB Patients

- Specific criteria vary with characteristics of patient population
- Respiratory Isolation of Patients with TB (RIPT) Protocol -- Harbor-UCLA, 1993
- Screening questionnaire at triage for TB risk factors and symptoms
- Immediate mask and chest X-ray for patients with suspected TB
- 10,674 patients screened, 2,242 CXRs, 645 abnormal CXRs
- 20 patients made 27 ED visits with active pulmonary TB
- RIPT protocol successful for 18/27 visits (67%)
- Major cause of protocol failure was failure to screen patients
- Chief complaints - 44% pulmonary, 52% medical, 4% traumatic

## Engineering Recommendations

1. Ventilation
  - Inadequate ventilation contributed to many nosocomial TB outbreaks
  - Single pass air flow from waiting rooms to outside
  - Air should always flow from more clean to less clean areas
  - ED's should ideally have  $\geq 1$  isolation rooms if seeing TB frequently
  - $\geq 12$  air changes per hour (ACH) for isolation rooms
  - "Negative pressure" airflow must be checked frequently
2. High Efficiency Particulate Air (HEPA) Filters
  - Removes particles  $\geq 0.3$  microns in diameter with  $\geq 99.97\%$  efficiency
  - Works on Aspergillus (1.5-6 microns)
  - Never tested on TB, but about the same size as Aspergillus
3. Ultraviolet Germicidal Irradiation (WGI)
  - Experimentally kills TB
  - Shown to kill other microbes in hospital studies
  - Most useful in waiting rooms
  - W-C light may cause adverse skin effects (directed light upward)

## Respiratory Protection

1. Surgical Masks
  - Indicated for source control
  - Worn by patients to decrease number of particles in air
  - Worn by family members of children with TB (often source of infection)
  - Not optimal for health care workers because air leaks around mask
2. Particulate Respirators (PRs)
  - Worn in isolation rooms and when transporting TB patients
  - Controversial what is sufficient and cost effective
  - CDC guidelines: filter 1 micron size  $\leq 95\%$  efficiency, fit tested to leak  $\leq 10\%$ , 3 sizes
  - Late 1995 - NIOSH certified N-95 masks

### 3. HEPA Filter Masks

- May be uncomfortable to breathe through
- Cost approximately 7 dollars each
- Exhalation valve -- not for patient use

### 4. N-95 Masks

- Meet 95% efficiency
- Cost -- less than 1 dollar to 3 dollars
- Still require fit testing

## PPD Testing in Health Care Workers

- Baseline test at beginning of employment
- Must be given intradennal
- 10 mm is positive for most HCWs
- Two-step test to prevent “booster phenomenon”
- High risk test q 3 months, intermediate q 6-12 months, low risk test yearly

## BCG Vaccination

- Reported efficacy 0% - 80%
- One meta-analysis showed efficacy of about 50%
- Unlikely to benefit HIV positive or already infected patients
- Skin tests may be positive, but usually < 10 mm
- One study showed BCG more effective than annual testing strategy
- Routine use in HCWs still controversial
- Indicated if ongoing exposure to INH or rifampin resistant patients

## Chemoprophylaxis

- Balance risk of developing active TB against risk of hepatitis
- Usually treat if recent PPD-conversion, known TB contact, medically predisposed to TB (e.g. on steroids), HIV positive, IVDA
- Usually treat age < 35 years, even if none of the above criteria
- Isoniazid 300mg daily (10 mg/kg/day in children)
- Treat for 6-12 months (9 months in children, 12 months if HIV positive)

## Treating Active TB

- Use at least 2 drugs to which organism is known to be susceptible
- 4 drugs used in initial regimen -- INH, PZA, rifampin, plus ethambutol or streptomycin
- Provides adequate regimen in 95% of patients
- Directly observed therapy (DOT) is preferred

## ED Exposure to TB

- Determine if a significant exposure has occurred
- Reinfection is rare in healthy, previously PPD-positive HCWs
- PPD negative and unprotected exposure- test baseline and 3 months
- If PPD converts – History and physical, chest X-ray, consider INH
- Beware of the booster phenomenon
- If CXR shows active TB, begin 4 meds
- Look for source susceptibility pattern

### **Final Recommendations to Prevent TB Exposure**

1. Review the environmental controls in your ED
2. Designate an area of the ED for respiratory isolation of TB patients
3. Always mask prior to chest x-ray if TB is on the differential diagnosis
4. Implement TB screening, even if only to catch most obvious cases:
  - Hemoptysis
  - HIV positive patients with pulmonary symptoms
  - Prior TB with fever or pulmonary symptoms
5. Consider TB in all patients with pneumonia regardless of location
6. A negative chest x-ray does not rule out TB in patients with AIDS
7. Remember that AIDS patients may have negative skin test
8. When admitting a patient for possible PCP always think about TB
9. Do not assume patients are not infectious based upon 1 or 2 negative APB smears
10. Do not assume a patient does not have TB because of previous treatment for TB

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