Mycobacterial Disease
Mycobacterium tuberculosis
Mycobacterium kansasii
Mycobacterium avium complex (MAC)

Mycobacterium tuberculosis complex

- Causative agents of tuberculosis
  - Mycobacterium tuberculosis (humans)
  - Mycobacterium bovis (primarily cattle)
  - Mycobacterium africanum

- Increase rate of infections
- Multi-drug resistance

Mycobacterium tuberculosis

Infection

- Inhalation of organisms after exposure
- Reach alveoli of lungs
- Most cases immune response is initiated and organism is walled-off in the lungs with no active disease

Mycobacterium tuberculosis

Active vs. Inactive Disease

- Inactive disease:
  - Organism is walled-off
  - Patient is symptom free and not infectious
  - Screening tests will be positive (TB skin test)
    - Once a screening test is +, will always be +
- Active disease or reactivation of disease
  - Organism multiplies
  - Patient is symptomatic and infectious

Mycobacterium tuberculosis

Active Disease - Symptoms

- Fever
- Shortness of breath
- Night sweats
- Chills
- Fatigue
- Anorexia and weight loss

Karen Honeycutt, M.Ed, MT(ASCP)SM
**Mycobacterium tuberculosis**

**Active Disease - Symptoms**
- Disseminated disease (extra-pulmonary / miliary)
  - Increase rate due to HIV infections
  - Common sites
    - Spleen, liver, bone marrow, kidney

**Mycobacterium tuberculosis**

**Prevention & Control**
- Three basic strategies are critical to the prevention and control of TB:
  - Identifying and completely treating persons with active TB.
  - Finding and evaluating persons who have had contact with TB patients, determining if they have TB infection or disease, and treating them appropriately (contact investigations).
  - Contact investigations are important for identifying persons who have active TB and infected persons at high risk for developing TB.
  - Screening populations at high risk for TB to locate persons infected with TB and giving complete therapy to prevent the infection from progressing to active, contagious disease. This screening also may identify cases of active disease.

**Mycobacterium tuberculosis**

**Tuberculosis – Screen tests**
- PPD or Tuberculin skin test (TST)
  - In vivo
  - Delayed hypersensitivity
- QuantiFERON®-TB Gold test
  - In vitro, performed on blood collected from the patient
  - Cell-mediated response
  - Measures the amount of interferon-gamma (INF-γ) secreted by a patient’s lymphocytes in whole blood in response to simulated mycobacterial antigens in vitro.

**Mycobacterium tuberculosis**

**Tuberculosis – Screen Recently Positive**
- Perform chest X-ray looking for active disease
  - No indications of active disease: still treat to prevent active disease (usually Isoniazid for 9 mos.)
- Active tuberculosis suspected
  - Sputum: Smear and culture x 3 first morning specimens
  - Nucleic Acid Probes performed on
    - Culture growth
    - Direct respiratory specimens (no more sensitive than direct smear)

**Mycobacterium tuberculosis**

**Tuberculosis – Laboratory Diagnosis**
- Direct specimen tests (sensitivity same for both methods)
  - Acid-fast stain
  - Nucleic acid probes
- If smear positive, perform nucleic acid probe to determine if possible *Mycobacterium tuberculosis (MTB complex)*
- Sputum culture
  - Growth detection usually around 2-4 weeks
  - Growth probed to determine if MTB complex (testing takes 48 hours)
  - Biochemical tests used to confirm identification (testing takes additional 2-4 weeks)

**Mycobacterium tuberculosis**

**Tuberculosis – Laboratory Diagnosis**
- Susceptibility testing: specialized methods used due to slow growth of organism
  - Results usually take 2-4 weeks after organism is isolated
- Primary-care practitioner is verbally informed at any stage of the process when smear/culture is positive
  - Due to lengthy process, often informed verbally with new information
Mycobacterium tuberculosis

Tuberculosis – Isolation
• Patient is maintained in negative-pressure, isolation room until:
  – *M. tuberculosis* ruled out (*M. kansasii* causes disease indistinguishable from MTB but is not transferred from person-to-person)
  – 2 weeks of successful treatment
  – Smear negative specimens on 3 successive days
  – Determined to be non-infectious by appropriate individual (Hospital Epidemiologist)

Mycobacterium tuberculosis

Tuberculosis – Treatment
• Active TB highly suspected or confirmed 3 to 4 drug combination
  – Isoniazid (INH)
  – Rifampin (RIF)
  – Ethambutol (ETB)
  – Pyrazinamide (PZA)
• Susceptibility information available: alter therapy, usually using 2 drugs
• Length of therapy usually 6-9 months

Mycobacterium kansasii

Overview
• Diagnosis and disease similar to MTB
• Organism is slow grower similar to MTB
• Most likely acquired through either aspiration or local inoculation from the environment
• Little evidence exists of person-to-person transmission.
• Treatment at least 18 months w/ 3 drugs (INH, RIF, ETB)

Mycobacterium avium complex

Overview
• Systemic disease in immunosuppressed, especially HIV+ (MAC attack) and chronic lung problems
  – Usually detected in blood culture (specifically order blood culture for mycobacteria..utilizes special medium, incubated for up to 8 weeks)
• Patient CD4+ cells <50-100 mm³
  – Primary prophylaxis
• Organism is slow grower similar to MTB
• Positive culture – treatment w/3 drugs until culture neg (usually 1-2 months)