Overview of Tuberculosis

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TB Epidemiology

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- TB IN THE UNITED STATES
- TB IN MICHIGAN
**Introduction**

- Spread via droplet nuclei
- Organism (bacteria) – *Mycobacterium tuberculosis*
- Latent TB infection (LTBI) – Not infectious or reportable
- TB disease – Majority of cases are infectious, reportable “CASE”

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**Global TB Disease Burden**

- An estimated 8.6 million new TB cases
- 1.3 million deaths due to TB disease
- 1/3 of the world’s population has TB infection
- The rate of decline remains low at 2% per year

Source: WHO Global Tuberculosis Report 2013
Global TB & HIV Burden

- Risk of developing TB is estimated to be 12-20X greater in people living with HIV than those without
- Of the 8.6 million new TB cases, 1.1 million (13%) were HIV-positive
- Out of the 1.3 million TB deaths, 320,000 (25%) deaths were among HIV-positive people

Source: WHO Global Tuberculosis Report 2013
High Burden Countries (WHO)

- Afghanistan
- Bangladesh
- Brazil
- Cambodia
- China
- Democratic Republic of the Congo
- Ethiopia
- India
- Indonesia
- Kenya
- Mozambique
- Myanmar
- Nigeria
- Pakistan
- Philippines
- Russian Federation
- South Africa
- Thailand
- Uganda
- United Republic of Tanzania
- Viet Nam
- Zimbabwe

BCG (Bacillus Calmette–Guérin)

- Vaccine used in many countries outside the USA
- Controversial efficacy
- Response wanes with time
- NOT a contraindication for skin testing
TB in the USA

Source: CDC National Tuberculosis Surveillance System Highlights from 2012

Reported TB Cases — United States, 1982–2012*

*Updated as of June 10, 2013


*Cases per 100,000. Updated as of March 24, 2014.
Number of TB Cases in U.S.-born vs. Foreign-born Persons — United States, 1993–2012*

Countries of Birth of Foreign-born Persons Reported with TB — United States, 2012

Reporting of HIV Test Results in Persons with TB by Age Group — United States, 1993–2012*
Estimated HIV Coinfection in Persons Reported with TB — United States, 1993–2012*

Note: Minimum estimates based on reported HIV-positive status among all TB cases in the age group.

TB in Michigan

Tuberculosis Cases and Case Rate — Michigan, 2009–2013
Percent of Tuberculosis Cases by Gender —Michigan, 2009–2013

Male
Female

Percent of Tuberculosis Cases by Age Groups —Michigan, 2009–2013

65+ yrs
45-64 yrs
25-44 yrs
15-24 yrs
5-14 yrs
0-4 yrs

Year
Percent
Tuberculosis Treatment Completion Within 12 Months for Eligible Patients — Michigan, 2009–2012

Contact Investigation on Sputum Smear-positive Tuberculosis Cases — Michigan, 2009–2012

Characteristics of Tuberculosis Cases by County—Michigan, 2009–2013
TB Transmission and Pathogenesis

TRANSMISSION
PATHOGENESIS
COMMON TB SITES
TB DISEASE IDENTIFICATION
TB DISEASE TREATMENT
TB INFECTION TREATMENT (LTBI)

Transmission

- Spread via droplet nuclei
- Organism (bacteria) – Mycobacterium tuberculosis
- Transmission factors:
  - Infectiousness of case
  - Environment of exposure
  - Duration of exposure
  - Virulence of the organism
Pathogenesis

- Inhale droplet nuclei
- Bacteria multiplies in alveoli
- Macrophages consume bacteria, then die
- Travel through the bloodstream, lymph system
- It may take 2-10 weeks to develop a positive reaction to TST

Infection vs. Disease

<table>
<thead>
<tr>
<th>Person with TB Infection</th>
<th>Person with TB Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a small amount of TB bacteria in his/her body that are alive but <strong>contained</strong></td>
<td>Has a large amount of active TB bacteria in his/her body that are <strong>multiplying</strong></td>
</tr>
<tr>
<td>Cannot spread TB bacteria to others</td>
<td>May spread TB bacteria to others</td>
</tr>
<tr>
<td>Does not feel sick, but may become sick if the bacteria become active in his/her body</td>
<td>May feel sick and may have symptoms such as cough, fever, and/or weight loss</td>
</tr>
<tr>
<td>Usually has a TB skin test or TB blood test reaction indicating TB infection</td>
<td>Usually has a TB skin test or TB blood test reaction indicating TB infection</td>
</tr>
<tr>
<td>CXR is typically normal</td>
<td>CXR may be abnormal</td>
</tr>
<tr>
<td>Sputum smears and cultures are negative</td>
<td>Sputum smears and cultures may be positive</td>
</tr>
<tr>
<td>Should consider treatment for TB infection to prevent TB disease</td>
<td>Needs treatment for TB disease</td>
</tr>
<tr>
<td>Does not require respiratory isolation</td>
<td>May require respiratory isolation</td>
</tr>
<tr>
<td><strong>Not a TB case</strong></td>
<td><strong>A TB case</strong></td>
</tr>
</tbody>
</table>

Pathogenesis

- 10% of infected persons with normal immune systems develop TB disease at some point in their life
- HIV is the strongest risk factor for development of TB disease if infected
  - Risk of developing TB disease 7% to 10% each year
Pathogenesis

- Certain other medical conditions increase risk that TB infection will progress to TB disease
  - Silicosis, diabetes mellitus, severe kidney disease, certain types of cancer
  - Certain intestinal conditions, organ transplant, immunosuppressive therapy
  - Children younger than the age of 5, persons who abuse drugs and/or alcohol

Common Sites of TB Disease

- Pulmonary (lungs)-most common, usually infectious
- Extra pulmonary
  - Pleura
  - Lymphatic system
  - Genitourinary systems
  - Bones and joints
  - Central nervous system
  - Disseminated (miliary TB)

TB Disease Identification

- Evaluation for TB
  - Physical examination (signs and symptoms)
  - Medical history
  - Test for TB Infection
    - Mantoux tuberculin skin test
    - IGRA (interferon-gamma release assay)
  - Chest radiograph
  - Bacteriologic or histologic exam
### TB Disease Identification

#### Signs and Symptoms
- Productive, prolonged cough (>2 weeks)
- Shortness of breath
- Chest pain
- Hemoptysis
- Fever/chills
- Appetite loss/Unexplained weight loss
- Night sweats
- Fatigue

#### History
- S/S
- Potential for exposure
- Past TB treatment
- Demographic risk factors
- Medical conditions that increase risk of TB
- HIV status (critical)

#### IGRA or Mantoux skin test
- Positive result indicates TB infection; must be interpreted with overall medical evaluation
- May be negative if:
  - Too soon after exposure
  - Severe illness
  - <6 months old
- Useful when S/S present
- Useful to determine how many people are infected

#### CXR
- Abnormalities often seen in apical or posterior segments of upper lobe or superior segments of lower lobe
- HIV: may be unusual
- Cannot confirm dx of TB

#### Specimens
- Sputum: 3 consecutive days
  - Spontaneous
  - Induced
  - Bronchoscopy
  - Gastric aspiration
- Laboratory
  - Smear
  - Culture
  - Genotyping
  - Susceptibilities
**Drug-Resistant TB**

- Drug susceptibility testing is conducted for all culture confirmed cases
- Drug-resistant TB is transmitted the same way as drug susceptible TB
- Drug resistance is divided into two types:
  - Primary resistance develops in persons initially infected with resistant organisms
  - Secondary resistance (acquired resistance) develops during TB therapy
- Case Definitions
  - MDR-TB: Multidrug Resistant TB
  - XDR-TB: Extensively Drug Resistant TB

**Infectiousness**

- Patients should be considered infectious if they
  - Are coughing
  - Are undergoing cough-inducing or aerosol-generating procedures, or
  - Have sputum smears positive for acid-fast bacilli and they
    - Are not receiving therapy (or)
    - Have just started therapy (or)
    - Have poor clinical response to therapy

**Infection Control**

- Administrative
  - Alert to S/S of *M. tb*
  - Early isolation of suspect cases
  - Prompt therapy with suspect cases
  - Alert for undiagnosed pulmonary illness with HIV
- Engineering
  - Neg. pressure isolation rooms
  - Enhanced air exchanges UV lights
  - Hepa filtration systems
- Personal protection
  - Client: surgical mask
  - HCW: N-95 respirator
**TB Disease Treatment**

- Provide safest, most effective therapy in shortest time
- Multiple drugs to which the organisms are susceptible
- Never add a single drug to a failing regimen
- Ensure adherence to therapy (DOT)

**TB Disease Treatment**

**Monitoring**
- Case management
- Client side effects
- Lab testing
  - Adverse reactions
  - Disease clearance

**Compliance**
- Without guidance or assistance, 25% do not complete therapy within one year
- DOT—directly observed therapy
- Incentives/enablers
- Accommodations for barriers

**TB Disease Treatment**

- Usually 6 months, some cases 9 months
  - Four drugs for two months
    - INH-RIF-PZA-EMB
  - Two drugs for four to seven months
    - INH-RIF
  - Intermittent therapy; option after 2 weeks of daily therapy
  - Adjust regimen when susceptibility results are known
  - Always maintain at least two effective drugs in regimen

**Extrapulmonary TB**
- Surgery may be an option
- May require longer therapy depending on the disease site and case
TB Disease Treatment

- **Children**
  - Prompt and aggressive
  - EMB not recommended
- **Pregnancy and Lactation**
  - Nine month therapy of INH, RIF, and EMB
  - PZA and SM are contraindicated
  - No toxic effect on breast milk
- **Monitoring for adverse reactions**
  - Baseline measurements
  - At least monthly
  - Must be individualized
  - Instruct patients to immediately report adverse reactions

Latent TB Infection (LTBI)

- Positive skin test and no disease
  - Reactor: no history of skin test or negative skin test > 2 years ago
  - Converter: History of negative skin test within past 2 years

LTBI Treatment

- TB disease must be ruled out
- If you test-you treat
- Pregnant women: treat if high risk for progression of LTBI to active disease
- Adults and children
  - INH for 9 months (daily or intermittent)
  - RIF for 4 months (daily)
LTBI Treatment

- Therapy Monitoring
  - Determine history of treatment for LTBI or disease
  - Assessment for contraindications
  - Obtain history of current medications
  - Concurrent medical conditions
  - Recommend HIV testing

LTBI Treatment

- Therapy Monitoring
  - Establish rapport and emphasize
    - Benefits of treatment
    - Possible side effects: n/v, anorexia, malaise, hepatitis, neurotoxicity, elev T. >3 days
    - Importance of adherence to regimen
    - Establishment of optimal follow-up plan

QUESTIONS?