Contact Investigations
Core Concepts: TB Transmission and TB Pathogenesis

Presented by:
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Objectives
- Describe the prevalence of TB in Southern Nevada
- Explain the difference between active TB disease and latent TB infection (LTBI)
- Determine co-morbid diseases and conditions that put patients at risk for reactivation of disease and poor clinical outcomes
- Discuss TB transmission and TB pathogenesis

Introduction
- *Mycobacterium tuberculosis* – Rod-shaped bacteria
- 3400 BC Egyptian mummy with spinal TB (Pott’s Disease)
- 2698 BC Chinese writing
- C. 1500 BC in Hindu writing
- 460 BC Greece – Phtisis
- Mentioned in Old Testament

Tuberculosis Transmission and Pathogenesis: What the DIIS Needs to Know
Introduction

• TB is one of the world’s deadliest diseases
• 1/3 of world’s population is infected with TB (2 billion people)
• 8 million people become ill with TB yearly
• 1-2 million TB related estimated deaths worldwide each year
• In 2014, TB killed 1.5 million people and HIV’s total death toll was estimated at 1.2 million, which included 400,000 deaths among HIV-positive people

Active TB in Clark County, Nevada

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Case Diagnosis</td>
<td>75</td>
<td>66</td>
<td>72</td>
</tr>
<tr>
<td>Foreign Born</td>
<td>65%</td>
<td>65%</td>
<td>71%</td>
</tr>
<tr>
<td>+19% Mexico</td>
<td>+0% Philippines</td>
<td>+0% Philippines</td>
<td></td>
</tr>
<tr>
<td>+13 additional countries</td>
<td>+16 additional countries</td>
<td>+10 additional countries</td>
<td></td>
</tr>
<tr>
<td>Homeless</td>
<td>5%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Uncontrolled Diabetes</td>
<td>16%</td>
<td>6%</td>
<td>22%</td>
</tr>
<tr>
<td>HIV/AIDS Co-infected</td>
<td>1%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Children born in US with risk factors</td>
<td>9%</td>
<td>5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Remember: TB is Transmitted Person to Person!

Every TB case Began as a TB contact

Tuberculosis Transmission and Pathogenesis: What the DIIS Needs to Know
TB Transmission

- When a person with infectious TB disease coughs, sneezes, speaks, or sings, tiny particles containing M. tuberculosis (droplet nuclei) may be expelled into the air.
- If another person inhales droplet nuclei, transmission may occur; however, not everyone who is exposed to TB becomes infected with TB.

What Factors Influence TB Transmission?

The probability that TB will be transmitted depends on the following factors:

1. Infectiousness of person with TB disease
2. Duration and frequency of exposure
3. Environment in which exposure occurred

1. Infectiousness of Person with TB Disease

Characteristics associated with infectiousness:

- TB of the lungs, airway, or larynx
- Presence of cough
- Positive sputum smear
- Cavity on chest x-ray
- Positive cultures
- Not covering mouth when coughing
- Not receiving adequate treatment
- Undergoing cough inducing procedures
2. Duration and Frequency of Exposure

Contacts at higher risk for TB infection are those who:

• Frequently spend a lot of time with the active case
• Have been physically close to the case

3. Environment in Which Exposure Occurred

Environmental characteristics that increase chances of TB transmission:

• Small or crowded rooms
• Areas that are poorly ventilated
• Rooms without air-filtering systems

The BEST way to stop transmission is to

• Identify and isolate infectious persons
• Start infectious persons on effective treatment for TB disease
Contact Investigation Core Concepts

TB Pathogenesis

What Happens Once Someone is Exposed To TB?

- Not every person who is exposed to TB becomes infected
- Persons who become infected will generally have a positive
  - Tuberculin skin test (TST)
  - Blood test (interferon gamma release assay [IGRA])
- Persons who become infected can have either:
  - Latent TB Infection
  - Active TB disease

Skin Test and Blood Test

- **Skin test**
  - Method of testing for TB infection in adults and children
  - 100+ years old

- **Blood test**
  - Newly approved
  - Measures interferon-gamma in whole blood in response to stimulation by purified protein derivative
  - Improved specificity and new generations being developed

- **NAC 4414.355 “Tuberculosis screening test”**
  - Means any tuberculosis screening test that has been:
    1. Approved by the FDA; and
    2. Endorsed by the CDC
Latent TB Infection (LTBI)
- LTBI - immune system keeps tubercle bacilli under control
- LTBI characteristics
  - Usually positive TST or IGRA
  - Not infectious
  - No symptoms
  - Normal chest x-ray
  - Sputum smears and cultures are negative
- Not a “case” of TB

Active TB Disease
- TB disease - immune system cannot stop tubercle bacilli from multiplying leading to active TB disease
- Usually affects lungs, but can affect other areas of the body
- Characteristics usually include:
  - Positive TST or IGRA
  - Infectious (before treatment)
  - Symptoms
  - Abnormal chest x-ray
  - Positive sputum smear and culture
- Considered a “case” of TB

What are Symptoms of TB Disease?
- Cough lasting 3 or more weeks
- Coughing up sputum or blood
- Fever
- Chills
- Night sweats
- Weight loss
- Appetite loss
- Fatigue
- Malaise
- Chest pain
LTBI vs. TB Disease

<table>
<thead>
<tr>
<th>LTBI</th>
<th>TB Disease (in the lungs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive tuberculosis bacilli in the body</td>
<td>Active tuberculosis bacilli in the body</td>
</tr>
<tr>
<td>TST or IGRA usually positive</td>
<td>TST or IGRA usually positive</td>
</tr>
<tr>
<td>Chest x-ray usually normal</td>
<td>Chest x-ray usually abnormal</td>
</tr>
<tr>
<td>Sputum smears and cultures negative</td>
<td>Sputum smears and cultures usually positive</td>
</tr>
<tr>
<td>No symptoms</td>
<td>Symptoms such as cough, fever, weight loss</td>
</tr>
<tr>
<td>Not infectious</td>
<td>Often infectious before treatment</td>
</tr>
<tr>
<td>Not a case of TB</td>
<td>A case of TB</td>
</tr>
</tbody>
</table>

Conditions that Increase Risk of Progressing to TB Disease

- Children younger than 5 years of age
- Weakened immune systems
  - Infection with HIV
  - Diabetes mellitus
  - Organ transplant
  - Silicosis
  - Severe kidney disease
  - Certain types of cancer
  - Certain intestinal conditions
  - Prolonged therapy with corticosteroids and other immunosuppressive therapy, such as prednisone and tumor necrosis factor-alpha (TNF-α) antagonists
- Chest x-ray findings suggestive of previous TB
- Low body weight
- Cigarette smokers and persons who abuse drugs and/or alcohol
- Recent TB infection (within past 2 years)

LTBI Progressing to TB Disease

- Risk of developing TB disease is highest in the first 2 years after infection (or, if foreign-born, first 2 years after immigration)
- People with LTBI can be treated to prevent development of TB disease
- Detecting LTBI early and providing treatment helps prevent new cases of TB disease

LTBI vs. TB Disease

- LTBI
  - Inactive tuberculosis bacilli in the body
  - TST or IGRA usually positive
  - Chest x-ray usually normal
  - Sputum smears and cultures negative
  - No symptoms
  - Not infectious
  - Not a case of TB

- TB Disease (in the lungs)
  - Active tuberculosis bacilli in the body
  - TST or IGRA usually positive
  - Chest x-ray usually abnormal
  - Sputum smears and cultures usually positive
  - Symptoms such as cough, fever, weight loss
  - Often infectious before treatment
  - A case of TB
Resources

• Division of Tuberculosis Elimination, Centers for Disease Control and Prevention
  http://www.cdc.gov/nchstp/tb

• Curry International Tuberculosis Center
  http://www.currytbcenter.ucsf.edu

• Southern Nevada Health District, TB Treatment and Control Clinic (702) 759-1370
  http://www.southernnevadahealthdistrict.org/tb

• Nevada State Health Division TB Program
  http://health.nv.gov/CD_HIV_TBProgram.htm