TB Transmission and Pathogenesis

Jan Dougan, RN
May 3, 2017

Essential Skills for the TB Nurse Case Manager
Little Rock, AR
May 3-4, 2017

Jan Dougan, RN has the following disclosures to make:

• No conflict of interests

• No relevant financial relationships with any commercial companies pertaining to this educational activity
Objective: Describe TB patient transmission
HISTORY OF TB

- Tuberculosis has been called consumption, the wasting disease, the white plague, and has affected humans for centuries.

- Robert Koch isolated the tubercle bacillus in 1882. He proved that it was caused by a living organism that could be passed as a microbe from person to person.

What is TB

- TB is an airborne disease caused by bacteria called Mycobacterium TB. The bacteria usually attack the lungs. TB bacteria can attack any part of the body. If not treated properly, can be fatal.
- TB is spread through the air from one person to another. The bacteria are put in the air when a person with active TB disease of the lungs or throat coughs or sneezes.
- People nearby may breathe in the bacteria and become infected.
Not everyone infected with TB bacteria becomes sick. People who are not sick have what is called Latent TB infection.

People with LTBI do not feel sick, do not have symptoms and can’t spread TB to others.

Some people with LTBI go on to get TB disease.

Transmission of TB

1. Droplet nuclei containing tubercle bacilli are inhaled, enter the lungs, and travel to the alveoli.

2. Tubercle bacilli multiply in the alveoli.
Special immune cells form a barrier shell (in this example below, bacilli are in the lungs) Within 2 to 8 weeks, special immune cells called macrophages ingest and surround the tubercle bacilli. The cells form a barrier shell, called a granuloma, that keeps the bacilli contained and under control (LTBI).
If the immune system cannot keep the tubercle bacilli under control, the bacilli begin to multiply rapidly (TB disease). This process can occur in different areas in the body, such as the lungs, kidneys, brain, or bone.

Pathogenesis

A small number of tubercle bacilli enter the bloodstream and spread throughout the body. The tubercle bacilli may reach any part of the body, including areas where TB disease is more likely to develop (such as the brain, larynx, lymph node, lung, spine, bone, or kidney).
Factors that Determine the Probability of Transmission of MTB

- Susceptibility
- Infectiousness
- Environment (enclosed living conditions)
- Exposure

Risk of Developing TB Disease

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk of Developing TB</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB infection and no risk factors</td>
<td></td>
<td>For people with TB infection, no risk factors, and no treatment, the risk is about 5% in the first 2 years after infection and about 10% over a lifetime.</td>
</tr>
<tr>
<td>TB infection and diabetes</td>
<td></td>
<td>For people with TB infection and diabetes, and with no treatment, the risk is three times as high, or about 30% over a lifetime.</td>
</tr>
<tr>
<td>TB infection and HIV infection</td>
<td></td>
<td>For people with TB infection and untreated HIV infection and with no LTBI treatment, the risk is about 7% to 10% PER YEAR, a very high risk over a lifetime.</td>
</tr>
</tbody>
</table>
### Persons at Increased Risk

- Persons infected with HIV;
- Children younger than 5 years of age;
- Persons who were recently infected with *M. tuberculosis* (within the past 2 years);
- Persons with a history of untreated or inadequately treated TB disease, including persons with fibrotic changes on chest radiograph consistent with prior TB disease;
- Persons who are receiving immunosuppressive therapy such as tumor necrosis factor-alpha (TNF) antagonists, systemic corticosteroids equivalent to/greater than 15 mg of prednisone per day, or immunosuppressive drug therapy following organ transplantation;
- Persons with silicosis, diabetes mellitus, chronic renal failure, leukemia, or cancer of the head, neck, or lung;
- Persons who have had a gastrectomy or jejunoileal bypass;
- Persons who weigh less than 90% of their ideal body weight;
- Cigarette smokers and persons who abuse drugs and/or alcohol; and
- Populations defined locally as having an increased incidence of disease due to *M. tuberculosis*, including medically underserved, low-income populations.

### ACTIVE TB

- 10% Lifetime risk in those with LTBI
- Symptomatic
  - Primary TB— generally affects the mid and lower lung; in children this form of TB is much more common.
  - Reactivation (post primary TB)— TB that generally affects upper lobes; sometimes with cavities and is usually found in adults. Sometimes called adult-type TB.
Questions?