Radiology for Panel Physicians... and Radiologists

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Outline

I. Setting the Stage

II. Radiologists and Panel Physicians: A Partnership

III. Commonalities in Countries’ Approach to Tuberculosis Work Up

IV. Digital radiography—Can You Sell It?
Learning Objectives

1. To increase participant understanding of the role of both panel physicians and radiologists in regard to the radiographic portion of the immigration medical examination.

2. To enhance understanding of the commonalities of the countries’ approaches to tuberculosis screening.

3. To increase participant understanding of the advantages and disadvantages of digital radiography for applicants, radiology departments, panel physicians, and facility administrators and owners.
Setting the Stage:

Please indicate your role in immigration screening by choosing one answer below:

A. Medical doctor examining applicant
B. Radiologist
C. Other panel site doctor
D. Other panel site staff (non-doctor)
E. Panel site administrator
As a panel physician, how do you review the chest radiographs of applicants you examine?

A. Look at every chest radiograph image
B. Look at a subset or sample of chest radiographs
C. Never review chest radiograph images
D. Look only at radiographs reported as abnormal by radiologist
On average, how many times per month do you discuss an applicant’s radiologic findings with a radiologist?

A. 0
B. 1-2
C. 3-5
D. 6 or more
RADIOLOGISTS & PANEL PHYSICIANS: A PARTNERSHIP
Case I: School Contact Investigation

- **13 year-old boy**
  - Coughing following month-long summer trip to India to visit family
  - Diagnosed in October with pulmonary TB

- **Contact:**
  - 12 year old boy is classmate and friend to case
  - IGRA positive
  - Asymptomatic
Case I:
12 Year Old Contact

IGRA Positive

Source:
Richardson Clinic
Decatur, GA, USA
Radiologist says CXR is normal. What do you think?

A. Agree
B. Disagree
C. Don’t know
If Disagree, Why?

A. Infiltrate “behind” the heart
B. Image not of good enough quality to interpret
C. Right hilar lymphadenopathy
D. Bone destruction in mid-thoracic spine
Answer

Right hilar lymphadenopathy
If an Applicant and You Disagree, What Do You, as Panel Physician, Do Next?

A. Nothing, radiologist is expert
B. Call or email radiologist
C. Walk over to radiologist’s reading room
D. Change reading on DS 3030 form and order smears and cultures, as panel physician is ultimate authority
Radiographic Appearance of Pediatric Primary TB

- **Pre-adolescence**
  - Lymphadenopathy most common
    - Hilar lymphadenopathy is hallmark
    - With or without small focus of air space consolidation
  - Usually right-sided
  - Pauci-bacillary
  - Young children often have no symptoms

- **Adolescents**
  - Adult-type TB disease pattern (cavities) more common
# Risk of Progression From Untreated Latent TB to TB Disease, By Age

<table>
<thead>
<tr>
<th>Age at Infection</th>
<th>Risk of TB Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth-12 months</td>
<td>43-50%</td>
</tr>
<tr>
<td>1-5 years</td>
<td>20-25%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>2%</td>
</tr>
<tr>
<td>11-15 years</td>
<td>16%</td>
</tr>
<tr>
<td>Healthy adults</td>
<td>5-10% lifetime risk</td>
</tr>
<tr>
<td>HIV-infected adults</td>
<td>30-50% lifetime risk</td>
</tr>
</tbody>
</table>

Case II: Overseas Screening

- 28 year old woman
- U.S. immigrant applicant with husband and 3 children, ages 6, 5, and 3
- No TB symptoms reported
- Insulin-dependent diabetic since first pregnancy
Image Read as Left Basilar Infiltrate

Source: Overseas image supplied by Richardson Clinic, Decatur, Georgia, USA
Radiologist says the CXR shows left basilar infiltrate. What do you think?

A. Agree
B. Disagree
C. Don’t know
If Disagree, Why?

A. Infiltrate “behind” the heart
B. Right-sided mediastinal lymphadenopathy
C. Image not of good enough quality to interpret
D. Liver mass pushing up diaphragm
Answer

Image not of good enough quality to interpret
If you disagree, what do you as the panel physician, do next?

A. Nothing, radiologist is expert
B. Call or email radiologist
C. Walk over to radiologist’s reading room
D. Change reading on DS 3030 form and order smears and cultures, as panel physician is ultimate authority
Quality Assessment

Image Quality

- ID correct (e.g., name, facility name, date of image)
- Entire thorax included (apices and costophrenic angles)
- Inspiration - 10 posterior ribs visible
- Contrast – multiple shades of grey
- Brightness – Can see thoracic spine intervertebral spaces behind the heart
- Rotation – shape of ribs symmetric and medial ends of clavicles equal-distant
- No artifacts
Case III: 48 Year Old Female Refugee

- Applicant for resettlement in United States
- Asymptomatic
- No history of tuberculosis
Case III: Radiologist’s interpretation:
Scattered opacities right lung and small left effusion

Source: Richardson Clinic
Decatur, GA, USA
What do you think of the radiologist’s interpretation?

A. Agree
B. Disagree
C. Don’t know
D. Think he was looking at someone else’s image
If Disagree, Why?

A. Left lung small (volume loss)

B. Multiple air-filled structures in left chest

C. Area behind heart too white

D. All of the above
What Did Panel Physician Do Next?

A. Emailed radiologist
B. Nothing
C. Walked over to radiologist’s reading room
D. Changed radiologist’s reading to indicate volume loss, lung cavities or cysts, and opacity at left lung base. Obtained TB smears and cultures.
Answer: Nothing
What Happened on U.S. Arrival?

- Refugee gave history of lung TB 6 years ago that was never treated

- Specimens being obtained for smear and culture

- Will treat with anti-TB drugs for minimum of 6 months and possibly longer
  - Even if smear and culture negative
  - DST to determine drug regimen if culture positive
Implications

- Do missed findings reflect on radiologist only, or on radiologist and panel physician?
  - Answer: radiologist and panel physician
  - CDC recommended termination of radiologist’s services

- Panel physician must coordinate work-up of applicant
  - In written Department of State agreement, panel physician is responsible for radiology and laboratory services
  - Ethical/moral responsibility
Commonalities in Approach to Tuberculosis Screening
29 Year Old Man
Contact to Wife

23 July 2013
35 Year Old Man With Shortness of Breath

Source:
Dr. Lisa Chen
Curry International Tuberculosis Center
San Francisco, CA
Older Man With Chronic Cough

Source: Dr. Lisa Chen
Curry International Tuberculosis Center
San Francisco, CA
4. Record of Special Findings Noted on the Applicant's Chest X-ray Film(s)

Please review the list below and check all appropriate boxes.

MINOR FINDINGS

☐ 1.1 Single fibrous streak / band / scar
☐ 1.2 Bony islets
☐ 2.1 Apical pleural capping with a smooth inferior border (< 1 cm. thick at all points)
☐ 2.2 Unilateral or bilateral costophrenic angle blunting (below the horizontal)
☐ 2.3 Calcified nodule(s) in the hilum / mediastinum with no pulmonary granulomas

MINOR FINDINGS (OCCasionally ASSOCIATED WITH TB INFECTION)

☐ 3.1 Solitary Granuloma (< 1 cm. and of any lobe) with an unremarkable hilum
☐ 3.2 Solitary Granuloma (< 1 cm. and of any lobe) with calcified / enlarged hilar lymph nodes

☐ 4.5 Non-calcified pleural fibrosis and / or effusion.
☐ 4.6 Interstitial fibrosis / parenchymal lung disease / acute pulmonary disease
☐ 4.7 ANY cavitating lesion OR "Fluffy" or "Soft" lesions felt likely to represent active TB.

☐ 4.2 Multiple / single pulmonary nodules / micronodules (noncalcified or poorly defined)
☐ 4.3 Isolated hilar or mediastinal mass/lymphadenopathy (noncalcified)
☐ 4.4 Single / multiple pulmonary nodules / masses ≥ 1 cm.
☐ 4.5 Non-calcified pleural fibrosis and / or effusion.
☐ 4.6 Interstitial fibrosis / parenchymal lung disease / acute pulmonary disease
☐ 4.7 ANY cavitating lesion OR "Fluffy" or "Soft" lesions felt likely to represent active TB.

☐ NONE OF THE ABOVE ARE PRESENT
Australian Requirements

- Sputum collection for AFB smear and TB culture x 3 is to be performed for any client with:
  - haemoptysis (coughing up blood)
  - radiological findings of infiltrate, cavitation or pleural effusion
  - any infectious or post infectious x-ray changes in an HIV positive person
  - any infectious or post infectious x-ray changes in a person who has clinical signs or symptoms of TB.

Further details can be found on page 27 of Panel Physician Instructions
Commonalities

Canada, Australia, U.S. require further work-up for infiltrate, cavity, effusion

Countries also concerned about:
- Clinical signs or symptoms of TB
- Increased risk of TB disease in HIV infection
Digital Radiography
Can You Sell It?
Digital Radiography Requirement

As of October 1, 2014, all U.S. panel physician sites must use digital radiography for chest radiographs of applicants for U.S. Immigration*

Includes all refugee resettlements

Australia/Canada already request that digital x-rays be used in medical screening

## Digital Radiography Systems

<table>
<thead>
<tr>
<th>Computed Radiography</th>
<th>Direct Digital Radiography</th>
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<tbody>
<tr>
<td>Add to analog machine</td>
<td>Free standing</td>
</tr>
<tr>
<td>Phosphor plate</td>
<td>No cassette or plate/cesium receptor</td>
</tr>
<tr>
<td>Plate reader to produce image</td>
<td>No reader</td>
</tr>
<tr>
<td>No darkroom</td>
<td>No darkroom</td>
</tr>
<tr>
<td>Same dose as analog</td>
<td>“Lower radiation dose” than analog</td>
</tr>
<tr>
<td>Image to CD</td>
<td>Image to CD</td>
</tr>
</tbody>
</table>
Digital Radiography

**Primary Advantages**

- Less technologist skill and knowledge needed
- No chemical processing (no darkroom)
  - Fewer variables affecting image appearance
  - *Lower long-term costs*
    - No film* or processor costs
- Better image labeling
- Faster
- Lower dose if DDR used correctly
- Remote 1interpretations or viewing (PACS)

* If upload image or use CD
Digital Radiography

Primary Disadvantages

- **Initial Cost**
  - New CR: 4 x cost of analog
  - New DDR: 10-15 x cost of analog

- **Stable electrical supply needed**

- **Radiation overexposure not initially apparent**
  - Software systems can log
Excessive Exposure with Automatic Rescaling

No rescaling

With automatic rescaling
Digital Radiography: Which Screen Must Radiologist Use For Interpretation?
Proper Monitor for Primary Image Interpretation

- Subtle findings can be missed on low resolution monitors!
- Need high resolution gray scale (3MP or higher) monitor for primary interpretation*
  - For radiologist, resolution insufficient on technologist’s workstation monitor or on regular desktop or laptop monitor (non-medical grade)
  - If primary interpretation already performed, others can review image on lower quality computer monitor, realizing may miss findings

* Applies to both CR and DDR technologies
Role of Chest CT in Tuberculosis Screening*

- Chest Computed Tomography (CT) Scans
  - Cannot differentiate TB from other conditions
  - Exposure equals, at a minimum:
    - 140 times exposure of plain chest PA view
    - 2 ½ years of natural radiation exposure

- Findings on plain radiographs, CT, and other radiologic studies only suggest TB

- Sputum smear and culture diagnose TB

CT may be indicated if screening finding suspicious for malignancy (TB smears and cultures remain required) or when treating for extensive TB disease
Thank You

Questions?