Pulmonary Tuberculosis - Two Contrasting Presentations

Jay Shendure, HMS III
Gillian Lieberman, MD

Core Radiology Clerkship, BIDMC
TB: Epidemiology

8 million cases / year (~284 in Massachusetts)

Primary infection (~70-90% asymptomatic) → Latency

1% risk of reactivation per year (10% with HIV)

Typical HPI: fever    weight loss    cough
              night-sweats    anorexia    hemoptysis

50% fatality if untreated
Pulmonary Manifestations of TB

71% pulmonary involvement only
20% extrapulmonary involvement only
9% pulmonary and extrapulmonary involvement

Ayala & Speilberg, Boards & Wards (2003)
## Typical CXR Findings in TB

<table>
<thead>
<tr>
<th></th>
<th>ACTIVE</th>
<th>LATENT</th>
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</thead>
<tbody>
<tr>
<td><strong>Lung</strong></td>
<td>Consolidation</td>
<td>Scarring</td>
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<tr>
<td></td>
<td>Cavities</td>
<td>Volume Loss</td>
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<tr>
<td></td>
<td>Focal Nodules</td>
<td>Destroyed Lobe</td>
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<tr>
<td></td>
<td>Miliary Nodular Pattern</td>
<td></td>
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<tr>
<td><strong>Hilum</strong></td>
<td>Lymphadenopathy</td>
<td>Calcified LNs (Ghon!)</td>
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<tr>
<td></td>
<td></td>
<td>Pericardial Calcification</td>
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<tr>
<td><strong>Pleura</strong></td>
<td>Effusion / empyema</td>
<td>Pleural Thickening</td>
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<td></td>
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<td>Pleural Calcification</td>
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</table>
Patient 1: Clinical Presentation

28 y/o male with a history of bronchitis

Presented at ED

HPI: Night-sweats, fever, non-productive cough
Patient 1: LUL confluent airspace opacities
Segmental consolidation

DDx

Lobar Pneumonia
Bronchopneumonia
Interstitial Pneumonia
Aspiration
TB or Atypical Mycobacterium
Trauma
Pulmonary Embolism
Obstructing Neoplasm
Mitral Regurgitation
Patient 1

History is important!

6 years ago, patient PPD converted after a trip to Zimbabwe

CXR read changed at dictation to TB until proven otherwise

But no cavitary lesions, etc, to clearly distinguish from community-acquired pneumonia
Patient 1: Rx

Discharged on levaquin, told to wear mask

Sputum obtained by bronchoscopy → AFB+

Started on standard TB therapy

Culture turned out to be pan-sensitive

Follow-up CXRs to monitor improvement
Patient 1: CXR follow up
1 month later

Patient 1: CXR follow up

BIDMC PACS
Patient 1: CXR follow up

6 wks later

BIDMC PACS
## Classic CXR Findings of Active TB

**HIV-negative, post-primary**

<table>
<thead>
<tr>
<th>Lesion Type</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Cavitary Lesions</td>
<td>41%</td>
</tr>
<tr>
<td>Upper Lobe Infiltrates</td>
<td>78%</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>18%</td>
</tr>
<tr>
<td>Effusion</td>
<td>11%</td>
</tr>
<tr>
<td>Lower/Mid Lobe Infiltrates</td>
<td>36%</td>
</tr>
<tr>
<td>Miliary</td>
<td>7%</td>
</tr>
<tr>
<td>Multilobular</td>
<td>50%</td>
</tr>
</tbody>
</table>

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But comorbidity (e.g. HIV, diabetes) increases chances of normal or atypical CXR

Geng et al (2005)
Patient 2

70 yo Vietnamese male, presents w/ multiple episodes of syncope

MRI (T1 w/ contrast) reveals multiple ring-enhancing lesions

DDx –
metastases
disseminated infection
multiple sclerosis

CT of chest, abdomen, pelvis
CT of Patient 2

Coalescing opacity in left upper lobe ("semi-cavitary")
CT of Patient 2

Calcified nodules in RUL and RLL

BWH / PACS
CT of Patient 2

Miliary Pattern – scattered tiny, nodular opacities
Miliary Pattern – hematogenous dissemination

“Innumberable” small, well-defined, randomly distributed nodules

DDx - TB, Mets, Sarcoid, Pneumoconiosis

http://www.pediatriconcall.com/fordoctor/DrugsandMedical/pulmonary_infect.asp (LEFT)
http://www.medinet.lk/othermedical/diagnosis.htm (RIGHT)
Patient 2

Ring-enhancing lesions – metastases vs infectious?

(1) Prior tuberculosis (RL calcified nodules)
(2) Active pulmonary TB (LUL cavitation)
(3) Miliary TB (disseminated nodules)

Sputum AFB neg x 3, Bx of lymph nodes AFB neg, PCR neg

Brain Bx put off, TB therapy started

Sputum culture eventually came back positive
Patient 2

Clinical improvement on TB Rx

Brain lesions reduced in size on repeated MRI (6 wks)
CXR is a mainstay for imaging TB

But CT can be useful in specific situations…

- incidental findings (Patient 2)

- more sensitive for detecting cavitations, miliary, and bronchogenic spread

- clarify ambiguous or absent CXR findings in the setting of strong clinical suspicion
Patient 1 – typical HPI
  typical pulmonary findings (CXR)
  exposure status from history
  pulmonary involvement only

Patient 2 – atypical HPI
  typical pulmonary findings (CT)
  exposure status from imaging
  pulmonary & extrapulmonary involvement
Classical Teaching of Typical Presentation

Why upper lobe? - Higher O2

Primary TB
- Lymphadenopathy
- Effusions
- Lower/middle lung infiltrates.

Postprimary TB
- Upper lobe infiltrates
- Cavitary lesions
New study that differs from conventional teaching

“RFLP clustering” to distinguish primary vs post-primary presentation on CXR

546 TB cases in NYC

No difference in CXR manifestation!

Specific conditions (e.g. HIV, diabetes, age) still increase chances of atypical findings

Geng et al., JAMA (2005)
References


Massachusetts Department of Public Health, Bureau of Communicable Disease Division of Tuberculosis Prevention and Control, Summary Statistics For the Year 2004.


Acknowledgements

Phillip Boiselle, MD (BIDMC)
Ann Kim, MD (BIDMC)

Rebecca Baron, MD (BWH)
Alexandra Molnar, MD (BWH)

Gillian Lieberman, MD (BIDMC)
Pamela Lepkowskki (BIDMC)
Larry Barbaras, Webmaster (BIDMC)
CT – “Tree in Bud” appearance – bronchogenic dissemination

http://www.med-ed.virginia.edu/courses/rad/hrct/treeinbud.htm
Ghon Lesion

Hilar LN and parenchymal involvement
Calcified remnant of primary infection

http://pathhsw5m54.ucsf.edu/cts/unknown19/primarytb.html
Cavitary Lesions

~50% of active, post-primary TB

Thick irregular walls

DDx – TB
  fungal
  septic emboli
  primary cancer or mets
  Wegner’s granulomatosis

Geng et al (2005)
TB: Epidemiology

One in three humans is infected with TB bacillus

90% of cases in developing world

USA: ~14,511 cases (2004)


HIV-fueled resurgence

WHO, MA-DPH