An Atlas of Imaging Findings in Pulmonary and Gastrointestinal Tuberculosis

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Agenda

• Patient Presentation
• Overview of Tuberculosis
  • Epidemiology
  • Evaluation of Pulmonary and Gastrointestinal TB
• Radiographic Appearance
  • Pulmonary TB
    • Primary
    • Post-Primary
    • Miliary
  • Gastrointestinal TB
• Management
• Patient Clinical Course
• Summary
Our Patient History

HPI:
• 56 year old male presenting with two months of loss of appetite and weight loss and approximately three weeks of nausea, vomiting, and abdominal pain
• Found to have positive QuantiFERON-TB Gold and caseating granulomas on colonoscopy at an outside hospital
• Visiting from South America

Social:
• Former healthcare worker
Our Patient: Chest X-ray

AP portable chest x-ray:
Distended loops of bowel.
AP portable chest x-ray:
*Opacity* in left lung near lingula. Bilateral *pleural effusions.*
C - coronal chest CT:
**Multiple nodules** in right upper lobe.
Our Patient: Chest CT

C- axial chest CT: 
Tree-in-bud pattern in right upper lobe.
C - axial chest CT:

*Patchy consolidation* in lingula. *Bilateral opacities* in posterior lungs indicating atelectasis, abutting pleural effusions.
C+ axial abdomen/pelvis CT:
Bowel wall thickening in hepatic flexure of colon, consistent with colitis.
Our Patient: Abdomen CT

C + axial abdomen/pelvis CT:

Inflammation in terminal ileum and cecum.
Differential Diagnosis

Tuberculosis

Crohn’s disease

Sarcoidosis

Lymphoma
# Differential Diagnosis

Distinguishing Tuberculosis from Crohn’s on Imaging:

<table>
<thead>
<tr>
<th></th>
<th>Tuberculosis</th>
<th>Crohn’s disease</th>
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</thead>
<tbody>
<tr>
<td>Chest radiograph</td>
<td>Positive chest film (50%)</td>
<td>Negative chest film</td>
</tr>
<tr>
<td>Barium</td>
<td>Fleischner sign</td>
<td>Cobblestone mucosa</td>
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<tr>
<td>CT</td>
<td>No creeping fat</td>
<td>Creeping fat</td>
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<tr>
<td></td>
<td>Omental and peritoneal thickening</td>
<td>Normal omentum and peritoneum</td>
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<tr>
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<td>Enlarged low density nodes</td>
<td>Enlarged soft tissue density nodes</td>
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</table>

Differential Diagnosis

Tuberculosis, with both pulmonary and GI involvement
- Positive QuantiFERON-TB Gold
- Caseating granulomas on colonoscopy
- Imaging consistent with infectious process
- Inhabitance in endemic region

Crohn’s disease
- Rarely affects lungs
- Tree-in-bud pattern more consistent with infectious than inflammatory process
- Presents with non-caseating, rather than caseating granulomas

Sarcoidosis
- Not consistent with +QuantiFERON-TB Gold or caseating granulomas

Lymphoma
- Tree-in-bud pattern and bowel wall thickening less consistent with lymphoma
- Not consistent with +QuantiFERON-TB Gold
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Epidemiology

- Annually:
  - 9 million new cases
  - 1.5 million deaths
  - 9,500 cases reported in U.S.
- Caused by M. tuberculosis
- Transmitted through respiratory fluids
- Classic symptoms
  - Fever
  - Night sweats
  - Cough
  - Weight loss
- Can impact nearly every organ system

Source: www.natureworldnews.com
Evaluation

- **Pulmonary:**
  - Acid-fast bacilli smear, sputum culture, CXR
  - PPD, IGRA (e.g., QuantiFERON Gold, T-SPOT)
  - Chest CT is more sensitive than chest x-ray for diagnosis, due to its ability to identify smaller nodules and abnormalities

- **Gastrointestinal:**
  - Biopsy
    - Caseating granulomas
  - Imaging
    - Non-specific findings
    - CT is the imaging modality of choice
Evaluation

Proposed algorithm for diagnosis of abdominal TB

High index of suspicion

USG of abdomen

- Suggestive
  - Treat
- Suspicious
  - Contrast barium studies
    - Classical
      - Treat
    - Suspicious
      - Endoscopic biopsy
    - Classical
      - Treat
- Normal
  - CECT abdomen
    - Doubtful
      - Perform FNAC/biopsy

Source: Sood et al., 2007.
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Pulmonary TB

- Primary vs. post-primary TB are often difficult to distinguish with imaging due to overlapping characteristics.
- Features seen in primary vs. post-primary TB:
  - **Primary TB**
    - Often normal imaging
    - Hilar and/or mediastinal lymphadenopathy
    - Pleural effusions
    - Focal consolidation, affecting any lobe
  - **Post-primary TB**
    - Usually abnormal imaging
    - Consolidation, nodular opacities in apical/posterior segments of upper lobes, superior segment of lower lobes
    - Cavitary lesions
Let’s view three companion patients with findings indicative of primary tuberculosis.
Companion Patient #1: Primary TB

Often non-specific findings, like patchy opacities

Source: Frank Gaillard, MD. Radiopaedia.
Consolidation may mimic bacterial pneumonia

Source: Tara Catanzano, MD. Medscape.
Companion Patient #3: Primary TB

May observe Ghon lesion (calcified granuloma), or **Ranke complex** (Ghon lesion with calcified hilar node).

Let’s view three companion patients with findings suggestive of **post-primary tuberculosis**.
Companion Patient #4: Post-Primary TB

Cavitary lesions may occur (chest x-ray)

Source: Hani Al Salam, MD. Radiopaedia.
Cavitary lesions may occur (chest CT)

Source: Natalie Yang, MD. Radiopaedia.
Companion Patient #6: Chest X-ray

- 70 year old male presenting with weight loss and 2.5 wks of productive cough
- History of treated TB
- Chest X-ray:
  - Cavitary left apical lung mass
  - Differential diagnosis
    - Post-primary TB
    - Mycetoma
    - Neoplasm
Companion Patient #6: Chest CT

- CT advised for further evaluation
- Sputum and bronchoscopy:
  - Negative for TB
  - Positive for aspergillus

Demonstrates importance of both clinical and radiologic information in diagnosis
Let’s view two companion patients with findings of miliary tuberculosis.
Companion Patient #7: Miliary TB

- Can occur with either primary or post-primary TB, although more common with primary
- Randomly distributed nodules

Source: Mark Holland, MD. Radiopaedia.
Companion Patient #8: Chest X-ray

- 31 year old male presenting with fever, mild dyspnea, 3-4 weeks of non-productive cough
- Chest X-ray:
  - Superior mediastinal mass
- CT revealed bilateral lymphadenopathy and tree-in-bud opacities
- Mediastinoscopy, lymph node biopsy, bronchoscopy: AFB+
- Started RIPE treatment
Companion Patient #8: Chest CT

- Patient found to have isoniazid resistance
- Follow-up CT: **new, diffuse random small nodules consistent with hematogenous spread** (miliary TB)
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Gastrointestinal TB

- Abdominal involvement may occur through:
  - Ingestion
  - Hematogenous spread
  - Lymphatics
  - Nearby infected foci
- Gastrointestinal TB is rare
  - Increased frequency in high-risk individuals (e.g., immunosuppressed)
- May impact any area of the GI tract
  - Especially:
    - Ileocecal valve
    - Terminal ileum
    - Cecum
  - Ileocecal area is involved in nearly 80-90% of cases
Gastrointestinal TB

- Plain radiograph
  - **Dilated bowel loops** caused by obstruction
  - Signs of perforation
- CT
  - Bowel wall thickening
  - Lymphadenopathy
  - **Low attenuated areas** suggesting **caseous necrosis**
  - Strictures
- Barium studies
  - Mucosal involvement (e.g., ulcers)
  - Fleischner sign – thickening or widening of the ileocecal valve with **narrowed terminal ileum**
  - Stierlin sign – **narrowing of terminal ileum** with rapid emptying into a diminished cecum
Let’s view five companion patients with findings of gastrointestinal tuberculosis on different modalities.
Companion Patient #9: Abdomen X-ray

- Plain radiograph
  - *Dilated bowel loops* caused by obstruction
  - Signs of perforation

Source: Jeremy Jones, MD. Radiopaedia.
Companion Patient #10: Abdomen CT

- CT
  - Bowel wall thickening, lymphadenopathy
  - Low attenuated areas suggesting caseous necrosis
  - Strictures

Companion Patient #11: Barium Study

- Barium studies
  - Stierlin sign
    - Narrowing of terminal ileum with rapid emptying into a diminished cecum

Source: Eisenberg, 1990.
Thickened, incompetent ileocecal valve
Companion Patient #13: Barium Study

Small cecum (1), narrowed terminal ileum (2), and dilated proximal ileum (3)

Source: Aditya Shetty, MD. Radiopaedia.
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Management

- Most patients: 6 month empiric treatment
  - 2 months – Rifampin, Isoniazid, Pyrazinamide, Ethambutol (RIPE)
  - 4 months – Rifampin, Isoniazid
- Latent TB:
  - Isoniazid daily for 9 months
- Multi-drug resistant tuberculosis:
  - Combination therapy
  - Surgical resection, if poor prognosis
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Our Patient: Clinical Course

- After being diagnosed with gastrointestinal tuberculosis, our patient was treated with rifampin, isoniazid, pyrazinamide, and ethambutol.
- Although several AFB smears returned negative, the decision to forgo bronchoscopy was made because RIPE therapy had already been initiated and bronchoscopy findings would not change management.
- Our patient was discharged from the hospital with follow-up arranged in his home country.
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Summary

- You learned how to distinguish tuberculosis from Crohn’s disease on imaging
- You learned about the most appropriate imaging modalities for pulmonary and gastrointestinal TB
- You were shown images demonstrating findings of primary, post-primary, and miliary tuberculosis and learned distinguishing features of each
- You learned about gastrointestinal TB and its predilection for the ileocecal area
- You were shown findings of gastrointestinal TB on different imaging modalities and learned about its characteristic features
- You briefly learned about the management of tuberculosis
References

References

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