Bronchiectasis:
An Imaging Approach

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Bronchiectasis

- Irreversible dilation of the bronchial tree

- Increasing incidence:
  - 8.7% increase in Medicare per year 2000-2007\(^1\)
  - >60% increased incidence in UK\(^2\)

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Bronchiectasis

- Irreversible dilation of the bronchial tree
- Increasing incidence:
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Bronchiectasis = increased mortality

Imaging of Bronchiectasis

Imaging Findings:
- Radiographic
- CT

Imaging-based differential diagnosis

Pitfalls/potential complications

Increasing incidence is at least partly due to use of CT
Bronchiectasis – Imaging Findings

• Radiography:
  – Bronchial wall thickening
  – ”Tram-track”
  – ”Ring-like” opacities
  – Plugged bronchi

Bronchiectasis – Imaging Findings

• Radiography:
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  – Paucity of vessels
Bronchiectasis

- Imaging Criteria
  - Radiography:
    - Bronchial wall thickening
    - "Tram track"
    - Plugged bronchi
    - "Ring like" opacities
    - Paucity of vessels

Diagnosing Bronchiectasis on CT
Diagnosing Bronchiectasis on CT

Bronchial dilation:

**Bronchoarterial Ratio**

1.5:1 or greater is almost always abnormal

Diagnosing Bronchiectasis on CT

Airways visible in peripheral lung
Diagnosing Bronchiectasis on CT
Decreased lung attenuation

Diagnosing Bronchiectasis on CT
Bronchial Wall Thickening
Diagnosing Bronchiectasis on CT
Mucus plugging
Centrilobular/Tree-in-Bud Nodules

Two Points of Clarification:

Bronchial dilation ≠ bronchiectasis

Bronchiectasis ≠ Traction bronchiectasis
Bronchiectasis is Irreversible

Not bronchiectasis!
(bronchial dilation)

Bronchiectasis ≠ Traction bronchiectasis
What imaging finding is most useful for making a specific diagnosis?

- Morphology of bronchiectasis
- **Distribution of abnormalities**
- Presence of lymphadenopathy
- Dilated bronchial arteries
Morphology:
– Tubular
– Varicoid
– Cystic

*Morphology is indicative of severity, but rarely helpful in diagnosis*

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**Bronchiectasis - Distribution**

• Distribution of abnormalities can help narrow differential diagnosis

• Based on CT, confident diagnosis >50% of the time

• HRCT + Clinical Information – Diagnosis >90%


2McShane PJ et al. Bronchiectasis in a diverse US population: effects of ethnicity on etiology and sputum culture. *Chest* 2012; 142:159-167
Distribution-based approach

- **Upper**
  - CF (may be diffuse)
  - Sarcoid

- **Mid/central**
  - ABPA
  - MAC

- **Lower**
  - Chronic infection
  - Conditions predisposing to chronic infection

*Pneumonia can cause asymmetric bronchiectasis anywhere*
56-year-old woman with asymmetric bronchiectasis

Remote tuberculosis

38-year-old with severe respiratory illness as child
**Swyer-James Syndrome**

38-year-old with severe respiratory illness as child

**23-year-old with recurrent LLL pneumonia**

*Always interrogate the proximal airways!*

Carcinoid Tumor
– **Upper**
  - CF (may be diffuse)
  - Sarcoid

– **Mid/central**
  - ABPA
  - MAC

– **Lower**
  - Chronic infection
  - Conditions predisposing to chronic infection

– **Asymmetric - Infection**

*Appropriate CT Technique Will Help With Distribution*
CT Technique

Step-and-Shoot  Volumetric

Lower-lobe predominant

Step-and-Shoot  Volumetric
Minimum Intensity Projection (MinIP)

- **Upper**
  - CF (may be diffuse)
  - Sarcoid
• Cystic Fibrosis
  – Upper lobe predominant or diffuse
  – Bronchial wall thickening
  – Nodular opacities → mucoid impaction
  – Mosaic attenuation → air trapping
• Cystic Fibrosis
  – Abnormal sweat chloride
  – Lung infection
  – Pancreatic insufficiency

56-year-old man with cystic fibrosis
40-year-old man with dyspnea and “bronchiectasis”

- **Upper**
  - CF (may be diffuse)
  - Sarcoid

- **Mid/central**
  - ABPA
  - MAC
51-year-old with asthma
• Allergic Bronchopulmonary Aspergillosis
  – Central bronchiectasis (close to hilum)
  – Mucus impaction
  – HAM (high attenuation mucus)
    • 1/3 of patients but specific
• Allergic Bronchopulmonary Aspergillosis
  – Central bronchiectasis (close to hilum)
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    • 1/3 of patients → but specific
Allergic bronchopulmonary mycosis (grew bipolaris species)

“finger in glove”

58-yo woman with chronic cough
https://well.blogs.nytimes.com/2013/06/06/think-like-a-doctor-a-cough-that-wont-quit/?ref=health
Atypical mycobacterial infection (M. Avium Complex)

- (non-classic form)
- Middle lobe/lingula
- Bronchiectasis
- Mucus plugging
- Tree-in-bud

Atypical mycobacterial infection (M. Avium Complex)

- Phenotype:
  - Thin
  - Older women
  - Scoliosis
  - Pectus excavatum
2/13/18

73-year-old woman with chronic cough

Mycobacterium Avium Complex
Findings can be subtle!
– Upper
  • CF (may be diffuse)
  • Sarcoid
– Mid/central
  • ABPA
  • MAC
– Lower
  • Chronic infection
  • Conditions predisposing to chronic infection

Lower-Lobe Predominant Bronchiectasis

• Immotile cilia
• Congenital tracheobronchomegaly
• Williams-Campbell Syndrome
• Immunodeficiency
  – CVID
  – Hypogammaglobulinemia
  – IgA deficiency
  – HIV
• Recurrent Aspiration
• Alpha-1 Antitrypsin
• Inflammatory bowel disease
• Constrictive bronchiolitis
• Idiopathic bronchiectasis
51-year-old man

**Situs?**

Immotile Cilia – Kartagener Syndrome
63-year-old man with Immotile Cilia

46-year-old woman ciliary dyskinesia

Situs inversus is not required!
49-year-old

Trachea?

Congenital Tracheobronchomegaly
76-year-old man – chronic aspiration

Swallowing Study?

67-year-old with Ulcerative Colitis

Systemic Disease?

10-years prior
59-year-old woman with rheumatoid arthritis, worsening obstruction.

37-year-old woman with possible immunodeficiency.
37-year-old woman

Common Variable Immunodeficiency

CVID  IgA  Hypogammablobulinemia
43-year-old man with dyspnea

Alpha-1 Antitrypsin Deficiency

- **Upper**
  - CF (may be diffuse)
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- **Lower**
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  - Conditions predisposing to chronic infection

- **Asymmetric - Infection**
Lower-Lobe Predominant Bronchiectasis

- Immotile cilia
- Congenital tracheobronchomegaly
- Williams-Campbell Syndrome
- Immunodeficiency
  - CVID
  - Hypogammaglobulinemia
  - IgA deficiency
  - HIV
- Recurrent Aspiration
- Alpha-1 Antitrypsin
- Inflammatory bowel disease
- Constrictive bronchiolitis
- Idiopathic bronchiectasis
- Situs?
- Trachea?
- Immune status?
- Alpha-1 antitrypsin?
- Aspiration?
- Inflammatory bowel disease?
- Connective tissue disease?

Bronchial Artery Hypertrophy

Hemoptysis

False-positive Pulmonary Embolism CT
71-year-old man with hemoptysis

Bronchial artery collaterals are common in bronchiectasis...
Bronchial artery collaterals are common in bronchiectasis...

...but other systemic collaterals can also form!
Intercostal arteries

Inferior phrenic
Cystic Fibrosis + Hemoptysis

?Pulmonary Embolism?

Bronchial Artery Inflow Can Cause Mixing Artifact
48-year-old man with hemoptysis – interpreted as PE

Negative D-dimer!
Conclusion

• CT is more sensitive than radiograph for detection of bronchiectasis

• Distribution of abnormalities is key to differential diagnosis (volumetric CT is a must)

• Beware of bronchial arteries
  – Hemoptysis
  – PE fakeout

Thank You!

For references and more information please see my website (below)

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THrads.com