MDCT of Large Airways: Pattern-Based Approach

Phillip M. Boiselle, M.D.
Director, Center for Airway Imaging
Assoc Dean, Harvard Medical School
Lecture Objectives

- Review MDCT imaging of large airways using pattern based approach
- Pearls and pitfalls
- Emphasize importance of routine inspection of airways on chest CT
- Inferior cricoid cartilage to carina
- 10-12 cm length
- 10-25 mm coronal
- 10-27 mm sagittal
- Coronal/Sagittal ratio = 1
Normal Axial CT Morphology

Assess shape, size, wall and lumen!
Dilation

- Congenital
  - Mounier Kuhn Syndrome
- Acquired
  - Pulmonary fibrosis
Lunate Trachea

INS

EXP
Focal Narrowing

- Enhanced detection MPR
- Post-intubation stenosis
- Extrinsic compression
  - Thyroid
  - Vascular
Diffuse Narrowing

- Saber sheath trachea
- Granulomatous disorders
- Polychondritis
- Amyloidosis
- Papillomatosis
- Rhinoscleroma (Klebsiella)
- Tracheobronchopathia Osteochondroplastica (TBO)
- Ulcerative Colitis
- Malignancy
Saber Sheath Trachea
Tracheal Wall

- 16-22 C-shaped cartilage rings
- Posterior membranous wall devoid of cartilage
- Wall ≤ 2 mm
Wall Thickening > 2 mm

- Spares post wall
  - Polychondritis
  - T.B.O.
- Circumferential
  - Everything else!
Tracheal Diverticulum

- Right posterolateral wall
- Thoracic inlet level
- 4% prevalence MDCT
- Acquired and congenital
- Pitfall: do not mistake for tracheal rupture
Tracheal Rupture
Endoluminal Mass

- Primary tracheal neoplasm
- Majority malignant in adults
- 2 most common:
  Squamous cell carcinoma
  Adenoid cystic carcinoma
Pitfall: Retained Secretions
Bronchi: Imaging Anatomy

- Divide by dichotomous branching
- **23** generations from trachea to alveoli, 8 visible HRCT
- Parallel pulm arteries
- Normal bronchus slightly smaller than artery
Endobronchial Lesion

- **Causes**
  - Neoplasms
  - Broncholithiasis
  - Foreign body
- **Secondary findings**
  - Air trapping
  - Lobar collapse
  - Mucous plugging
  - Bronchiectasis
Endobronchial common site missed lung cancer CT!

Bronchial Narrowing

• Intrinsic stenosis
  » Infection (TB)
  » Iatrogenic
  » Neoplasm
  » Inflammatory
  » Post-transplant

• Extrinsic compression
  » Lymph nodes
  » Masses
Dilation = Bronchiectasis

- Permanent bronchial dilation
- Infections, sputum, cough, hemoptysis
- Reid Classification
  - Cylindrical
  - Varicoid
  - Cystic (saccular)
CT Criteria

• **Peripheral location**
  » Peripheral 1 cm lung
  » Abutting MS/costal pleura

• **Lack of tapering**

• **BA ratio > 1**
  » Signet-ring sign

• **+/- Wall thickening**
Pitfall: Bronchi in Elderly

- Bronchial dilation observed at thin-section CT in 60% of asymptomatic adults > 75 years of age compared to 6% <55 years of age
  - urban dwellers, ex- and non-smokers
- No relationship with smoking
  - Copley S et al Radiology 2009;251:566-573
Focal Bronchiectasis

- Post-infectious
  - bacterial, viral, mycobacterial
- Foreign body
- Endobronchial neoplasm
- Bronchial stricture
When you see focal bronchiectasis, always inspect the more proximal airways for endobronchial tumor or stricture!
Diffuse Bronchiectasis

- Cystic fibrosis
- Sarcoidosis
- Post-radiation fibrosis
- Atypical mycobacterial infection
- Immotile cilia syndrome
- Idiopathic
- Post-infectious
- Repeated aspiration
- Fibrotic lung disease
- ABPA
- Mounier-Kuhn’s Syndrome

Zonal distribution

Central predominance
Bronchi in COPD

- Wall thickening
- Irregularity
- Diverticula
- Bronchiectasis
- Bronchomalacia
Bronchial Diverticula

- Focal outpouchings
- Enhanced depiction MDCT, especially with thin-section coronal reformations
- Pitfall: not pathognomonic for COPD
Always inspect airways on CT

Pattern based approach assists diagnosis

Avoid pitfalls

pboisell@bidmc.harvard.edu