Avoid the Traps!

Tips for Identifying and Distinguishing Normal Thoracic CT Findings from Pathology.

Aman Jivraj, Joy Borgaonkar, Daria Manos, Robert Miller
Dalhousie University, Halifax NS, Canada
- None
1. Identify commonly misinterpreted normal thoracic CT findings.

2. Describe the characteristic CT features of these normal findings.

3. Discuss how to differentiate these normal findings from similar appearing pathology.
Case # 1
Trauma. Can you clear the aorta?
Prominent Right 3rd Intercostal-Bronchial Artery Trunk

May be mistaken for:
- Acute traumatic aortic injury
- Aortic pseudo-aneurysm

Discussion:
- Also known as:
  - right intercostal-bronchial trunk
  - superior intercostal artery
  - uppermost intercostal artery
  - highest thoracic intercostal artery
- Supplies the 2nd and 3rd intercostal spaces (usually more prominent than the same artery on the left)

Tips:
- Arises at the origin of the right 3rd intercostal artery
- Conical, symmetrical bulge with smooth, uninterrupted margins
- Vessel emanates from the apex of the bulge and extends to the intercostal space

Fisher RG, Sanchez-Torres M, Whigham CJ, Thomas JW. “Lumps” and “Bumps” that Mimic Acute Aortic and Brachiocephalic Vessel Injury. RadioGraphics 1997; 17: 825-834
Case # 2
Screening CT. Does this need follow-up?
Chronic Interstitial Opacities Related to Thoracic Spine Osteophytes

May be mistaken for:
- Focal pneumonia
- Adenocarcinoma in-situ
- Interstitial lung disease

Discussion:
- Enlarged osteophytes cause direct compression of the adjacent lung parenchyma
- These do not resolve in the prone position, and are therefore permanent changes
- Most commonly seen in the right lung, as pulsations from the aorta inhibit excess bone formation on the left side of the thoracic spine
- Histologic examination of the affected tissue showed fibrosis

Tips:
- Reticular and linear patterns adjacent to the thoracic spine
- Direct relationship between the thickness of the osteophyte and the incidence of adjacent interstitial opacities
- The relationship between the osteophytes and the adjacent parenchymal opacity is best appreciated on coronal views by comparing bone and lung windows

Otake S, Takahashi M, Ishigaki T. Focal Pulmonary Interstitial Opacities Adjacent to Thoracic Spine Osteophytes. AJR 2002; 179:4, 893-896
Case #3
Outpatient with cough
Benign Bronchial Diverticula

May be mistaken for:
- Pneumomediastinum
- Pathologic diverticula secondary to COPD
- Mounier-Kuhn Syndrome

Discussion:
- Often found incidentally in smokers and non-smokers
- Bronchial diverticula can be found in 30% of asymptomatic patients
- No significant age related predominance
- Higher prevalence in male patients

Tips:
- Most commonly subcarinal
- Most commonly < 3 diverticula
- In contrast to pathologic diverticula related to smoking:
  - Multiple diverticula
  - Main and lobar distribution

Case #4
78 year asymptomatic patient. Is this normal?
Normal Lung Morphology of the Elderly Patient

May be mistaken for:
- Interstitial Lung Disease
  - Most similar to UIP (usual interstitial pneumonia)

Discussion:
- Elderly patients are defined as >75 yo
- Changes occur due to age-related loss of elastic recoil in both alveoli and airways resulting in:
  - Increase in the size of airspace
  - Dilatation of alveoli
  - Decrease in gas-exchange surface area
  - Decreased supporting tissue for small airways
- Seen in asymptomatic patients regardless of smoking history

Tips:
- Pure reticular pattern without honeycombing
  - Bilateral
  - Sub-pleural distribution
  - Basal predominance
- Scattered cysts
- Bronchial dilatation
- Bronchial wall thickening

Copley S. et al. Lung Morphology in the Elderly: Comparative CT Study of Subjects over 75 Years Old versus Those under 55 Years Old. Radiology May 2009; 251: 2, 566-573
Case #5
50 pack year smoker. Does this need follow-up?
Benign Perifissural Opacity

May be mistaken for:
-Malignant/ pre-malignant pulmonary nodule

Discussion:
- Up to 20% of pulmonary nodules are located adjacent to a fissure
- Commonly found on screening CT scans of smokers and non-smokers
- Thought to represent lymph nodes
- Growth is not related to malignant potential
- Do not require follow-up

Tips:
- Well-circumscribed, smoothly marginated nodules
- In contact with or closely related to a fissure
- Most often triangular or oval
- Commonly show a septal attachment
- Usually located below the level of the carina

Case #6
IBD patient on Infliximab. Prior granulomatous disease?
Azygous Arch Valve

May be mistaken for:
- Calcified mediastinal lymph node

Discussion:
- Azygous vein:
  - Crosses from posterior to anterior
  - Superior to the right main bronchus and right PA
  - Drains into the SVC
- Azygous valve:
  - Bicuspid, one way valve
  - Found in up to 30% of patients
- Reflux of IV contrast into the azygous vein can be seen in >50% contrast enhanced studies

Tips:
- Compare to an unenhanced study if available
- The mean distance between the SVC and the azygous valve is 1.9 cm
- Contrast material layers within the cusps of the valves creating two discrete foci of increased density
- Azygous vein reflux most commonly occurs with high contrast injection rates (PE studies, right arm injections)

Case #7
Where is this lesion?
Extra-pleural Fat

May be mistaken for:
- Parenchymal:
  Pulmonary infarct, pneumonia, atelectasis, or scaring
- Pleural-based:
  Loculated effusion, extra-pleural hematoma, or pleural based tumor

Discussion:
- Located superficial to the parietal pleura, within the chest wall
- Composed of loose connective tissue of the endo-thoracic fascia
- Can be drawn into fissures appearing to invade the lung parenchyma

Tips:
- Often bilateral
- Similar in appearance to extra-thoracic fat
- Houndsfield units of macroscopic fat (< -50 HU)
- Most abundant along the posterolateral aspect of the fourth to eighth ribs

Fisher ER, Godwin JD. Extrapleural Fat Collections: Pseudotumors and Other Confusing Manifestations. AJR 1993;161:47-52
Case #8
Is this too much thymus?
Normal Adult Thymus

May be mistaken for:
- Thymoma
- Enlarged lymph node/ Lymphoma
- Thyroid/ parathyroid tissue
- Teratoma
- Thoracic aorta aneurysm

Discussion:
- Composed of two lobes
- After puberty the thymus begins to "involute" with fatty replacement (50% fatty replacement by age 40, and complete replacement by age 50)
- Progressive decrease in thickness with increasing age
- Largest normal thymus in a patient >20: 1.3 cm
- Average thymic thickness at age 40-50: 0.5 cm

Tips:
- Midline structure located in the anterior mediastinum, in the perivascular space between the heart and the sternum superiorly
- Homogeneous soft tissue density
- Arrowhead shaped with smooth straight or concave margins

Francis IR, Glazer GM, Bookstein FL, Gross BH. The thymus: reexamination of age-related changes in size and shape. AJR 1985;145:2, 249-254
Case #9
Trauma. Can you clear this aorta?
**Pericardial Recess**

**May be mistaken for:**
- Mediastinal or hilar lymphadenopathy
- Mediastinal soft tissue lesion
- Pericardial effusion
- Aortic leak/thrombus

**Discussion:**
- The inner (serous) layer of the pericardium is composed of an inner visceral layer (epicardium) and an outer parietal layer
- The pericardial cavity lies between the visceral and parietal layers of the serous pericardium, usually containing 20-25 ml of lubricating fluid
- Various reflections of the serous pericardium separate the pericardial cavity into pericardial sinuses and recesses

**Tips:**
- Simple fluid density (0-20 HU) that does not enhance with contrast administration
- Refer to the provided diagrams for specific locations of known pericardial recesses and sinuses

*Truong M et al. Anatomy of Pericardial Recesses on Multi-detector CT: Implications for Oncologic Imaging. AJR 2003, 181, 1109-1113*
Pericardial Recess

Level of the right pulmonary artery

Below the right pulmonary artery

Level of the left atrium

Case #10

50 pack year smoker. Is this DIP (Desquamative Interstitial Pneumonia)?
Dependent Atelectasis

May be mistaken for:
- Pneumonia
- Aspiration
- Interstitial lung disease (DIP)

Discussion:
- Collapse of the dependent portion of the lungs due to incomplete expansion
- Completely reversible
- Distribution varies with position
- Commonly seen due to the supine positioning during CT scan acquisition

Tips:
- Usually a bilateral process
- Most commonly involves the posterior lower lobes on a supine study
- Normal expansion is demonstrated when comparing supine and prone imaging

Conclusion

A familiarity with key normal thoracic CT findings will help the radiologist avoid errors in interpretation and will prevent unnecessary work up.