Fatty Lesions Of The Chest: A Pictorial Review

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Learning Objectives / Outcomes

Describe common and uncommon fat-containing lesions of the mediastinum, lung, pleura, chest wall and diaphragm

Narrow the differential diagnosis of fatty lesions based on its location, imaging features, associated findings and clinical data
Introduction

Majority of the lesions in the chest ➔ soft-tissue attenuation ➔ NONSPECIFIC!

Some lesions ➔ **FAT** (-40 to -120 HU at CT or signal intensity of fat at MR*) ➔ Narrow your diagnosis!

*hyperintense T1 and T2-weighted images and decreased signal intensity on fat-saturation techniques

**FAT** Additional characteristics of lesion and location
LOCATION BASED DIFFERENTIALS OF FATTY CONTAINING LESIONS

Everywhere

- Lipoma
- Liposarcoma

Location Specific

Endobronchial
- Hamartoma

Parenchimal
- Hamartoma
- Lipoid pneumonia

Mediastinal
- Thymolipoma / Thymoliposarcoma
- Teratoma / Teratocarcinoma
- Lipomatous hypertrophy of the interatrial septum

Chest wall and pleura
- Familial Multiple Lipomatosis
- Duchenne Muscular Dystrophy

Diaphragm
- Hernia Morgagni / Bochdalek
- Acquired hernia (hiatal / post-traumatic / iatrogenic)
Lipoma

Most common soft tissue tumor; 50-70 years of age; maybe multiple ($\approx 5\%$)

Slow growth $\Rightarrow$ symptoms of local compression

Benign encapsulated mesenchymal tumors $\Rightarrow$ resembles normal fat (imaging and histologically)

Avascular appearance, with homogeneous fat attenuation, well-defined margins
Lipoma - Endobronchial

Contrast-enhanced CT coronal and axial images show an endobronchial mass with homogeneous fat attenuation filling the right superior bronchus (arrow).

- Cough (81%); Rare (0.1% pulmonary tumors; 3.2%–9.5% of benign endobronchial tumors)
- Pedunculated; Predilection for mainstem bronchi
- Bronchoscopic biopsies ➔ frequently nondiagnostic ➔ thick fibrous capsule or secondary to chronic inflammation
Lipoma - Mediastinal

Pericardial Lipoma. Contrast-enhanced CT scan of the chest demonstrates a large low-attenuation lesion, well-defined and confined to the pericardium. The mass demonstrates no enhancing components and has no signs of invasion of adjacent structures. There is associated mass effect on the adjacent lung.

Myocardial Lipoma. Contrast-enhanced CT scan of the chest demonstrates a small fat attenuation lesion (small blue arrow), well-defined within the myocardium. The mass demonstrates no enhancing.

- Rare; Most patients are asymptomatics
- Cardiac lipomas: endocardial, myocardial and epicardial ➔ arrhythmias or obstructive symptoms if intracavitary
- Pericardial: may compress ventricles/ lung ➔ shorness of breath
- Differential Diagnosis: Lipomatous hypertrophy of the interatrial septum
Pleural Lipoma. (a) Coronal CT reconstruction image demonstrate large fat attenuation lesion (star), adjacent to the diaphragm, with subsegmental restrictive atelectasis of the lung. Note that there is no enhancement. (b) CT scan of a different patient shows a pleural mass with fat attenuation (similar to the subcutaneous fat) adjacent to the left upper lobe (circle). There is no destruction of the rib.
Cervicothoracic Lipoma. Axial images of contrast-enhanced CT scan demonstrate a fat-attenuation lesion, well-defined (star), extending from the cervical to the superior hemithorax, in the subpeitoral and infraclavicular region. There is no enhancing components and no signs of invasion of adjacent structures. Otherwise, there is evidence of extrinsic compression on the left subclavian vein (small blue arrow) at the level of the 1st rib consistent with an outlet thoracic syndrome (patient has brachialgia, loss of strength and Raynaud’s phenomenon).
Liposarcoma

Mean age of 50 years;

- Low grade ➔ Well-differentiated ➔ most common (50%); highest amount of fat
- Intermediate grade ➔ Myxoid
- High grade (aggressive with frequent metastases) ➔ Round cell and Pleomorphic (least common)
- Mixed

*Imaging findings depend on pathology!*
**Liposarcoma**

**Inhomogeneous** appearance:

- Thickened and irregular **septa**
- **Contrast-enhancement**
- Nodular / globular or mass-like nonadipose areas
- Total amount of **nonfat tissue** component > 25%

Well-differentiated > 75% of fat tissue and other histologic subtypes have < 25%

Larger than lipomas
Liposarcoma of the esophagus. Expansive and heterogeneous lesion of the esophagus, with fatty components showing low-attenuation on CT (A), and signal-drop between in-phase (B) and out-phase (C) MRI series. The mass causes anterior displacement of the superior mediastinal vessels.
Endobronchial and Parenchimal - Hamartoma

Most common benign pulmonary neoplasm; 4th-7th decades; M>F.

Cartilage, fat, fibrous tissue and epithelial components.

Intrapulmonary

Round/ovoid solitary lobulated nodules with well-defined margins
Most frequent: Periphery (but can be seen in all parts)
Calcifications (5-50%) - Popcorn-like calcifications (minority cases)

Definitive diagnosis ➔ presence of FAT (-40 to -120 HU): 50% of cases - localized or generalized (no need for biopsy!)

Obs.: hamartomas of soft-tissue attenuation (no evidence of intralesional fat) ➔ nonspecific pulmonary nodule
Endobronchial and Parenchimal - **Hamartoma**

**Lung Parenchymal Hamartoma.**
(a) CT scan shows a solitary pulmonary lobulated nodule containing foci of fat attenuation (red arrow) and calcifications. (b) Axial contrast-enhanced CT scan demonstrates a solitary well-circumscribed pulmonary nodule with diffuse fat attenuation (blue arrow).
Endobronchial and Parenchimal - Hamartoma

(a) Coronal and (b) axial CT images show a large heterogenous pulmonary mass containing foci of fat attenuation (red arrows) and popcorn-like calcifications (blue arrows).
Endobronchial and Parenchimal Hamartoma

20% ➔ symptoms from bronchial obstruction (chronic cough, hemoptises and fever)

Similar to intrapulmonary but typically contains more fat tissue; Post-obstructive findings.

Endobronchial Hamartoma. (a) Coronal and (b) axial CT images show an endobronchial lesion with predominant fat attenuation (red arrows) and small foci of calcifications (blue arrows) involving the left main bronchus and the origin of the lower lobe bronchus.
Parenchimal - *Lipoid pneumonia*

Inflammatory condition ➔ chronic aspiration of artificial or natural oils into the lungs

**Exogenous** (neuromuscular disorders and esophageal abnormalities)

Rarely: **Endogenous** (accumulation of lipids beyond a bronchial obstruction, such as a bronchial tumor)

Debilitated adults or in children with anatomic defects (cleft palate)

Progressive dyspnea and fever
Parenchimal - *Lipoid pneumonia*

Airspace consolidation with fat attenuation ➔ unilateral or bilateral

“Crazy-paving” pattern (interlobular septal thickening and superimposed ground-glass opacities)

Fibrotic changes ➔ traction bronchiectasis and honeycombing

Dependent portions of the lungs are predominantly involved

*Diagnosis: clinical and radiographic features together!*
**Lipoid Pneumonia.**

Exogenous lipoid pneumonia due to chronic aspiration of mineral oil.  
**A,** CT image shows areas of fat attenuation within consolidation (*arrows*).  
**B,** Axial CT image shows consolidative and ground-glass opacities bilaterally.
Mediastinal – *Fat-containing neoplasms*

**Germ cell tumors** ➔ heterogeneous mixture of tissue;

- Most common: *Mature teratoma* – well-defined, fat containing mass in the anterior mediastinum with **cystic areas** and irregular **calcifications**
- **Malignant** components (teratocarcinoma) or mixed aggresive features (mixed germ cell tumor with immature teratoma) ➔ less well defined; signs of **invasion**

**Thymolipoma** ➔ mature thymic and adipose tissue;

- Difficult to differentiate from teratoma: **absence of cystic changes** and origin from the **thymic bed** maybe helpful
- Slowly growing, large, pliable, well-defined encapsulated masses
- Fat content constitutes 50-85%; small amounts of solid areas and fibrous septa
- Rarely: thymolipossarcoma (lipossarcoma-like features)

*Remember in myasthenia gravis!*
Mediastinal – *Fat-containing neoplasms*

**Thymolipoma.** CT axial image shows small well defined encapsulated lesion (star) with fat content and fibrous septa originating from the thymic bed.
Fatty Myocardial Foci in Patients with Tuberous Sclerosis Complex (TSC)

- unclear origin; may represent sequelae of regressed rhabdomyomas, but recent evidence suggests origin from perivascular epithelioid cells

  Unique location: unencapsulated deposits of mid-myocardial fat at the interventricular septum or left ventricular wall
  Differential diagnosis: true myocardial lipomas (irregular and capsulated) and arrhythmogenic right ventricular dysplasia (ARVD)

Cardiomyopathies

ARVD ➔ fatty or fibrofatty replacement of the normal right ventricular (RV) myocardium; can affect the left ventricle; diffuse fatty infiltration of the ventricles

  MR ➔ RV enlargement and poor function, wall motion abnormalities and the presence of fat
  Chronic myocardial infarct ➔ curvilinear fatty deposition in a subendocardial or transmural vascular distribution
Fatty Focus in the Myocardium in Patient with Tuberous Sclerosis Complex (TSC). Nongated contrast-enhanced CT image in patient with TSC shows large fatty focus in the interventricular septum (arrow).
Chest wall - *Muscular dystrophies*

**Fatty liposubstitution of muscle**

Specific patterns of muscle fatty replacement and atrophy ➔ narrow the differential diagnosis

**MR ➔ characteristic findings,** determine biopsy sites and control therapeutic interventions

**Duchenne muscular dystrophy.** Diffuse atrophy and liposubstitution of chest wall muscles.

Duchenne muscular dystrophy: most common neuromuscular disorders in children (X-linked recessive disorder)
**Familial Multiple Lipomatosis.** CT scan shows diffuse infiltration of fat between the thoracic paraspinal muscles (arrows), as well as infiltration of the left anterior abdominal wall musculature (*). 

Hereditary syndrome of multiple lipomas (autosomal dominant transmission) 
Extremely rare; M> F; Relative sparing of head and shoulders
Take Home Message

CT and MR imaging are extremely valuable to show intralesional fat and can narrow the differential diagnosis based on its imaging features and location.

Often a definitive radiologic diagnosis can be made without a biopsy!

I will never look to fat the same way again! How about you?


F. Molinari, A. A. Bankier, R. L. Eisenberg. Fat-Containing Lesions in Adult Thoracic Imaging. AJR. 2011;197: W795-W813


Thank you!

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