CT OF FATTY LESIONS IN THE MEDIASTINUM

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Introduction

“The identification of fat within a focal or diffuse mediastinal lesion significantly narrows the differential diagnosis…” and “In many cases, a specific diagnosis can be suggested on the basis of CT findings.”

- PM Boiselle and ML Rosado-de-Christenson

(JCAT 25(6): 881-889)
CT Assessment of the Mediastinum

• CT is the most frequently used modality to evaluate the mediastinum
  – Resolves complicated anatomical pathology presented on CXR
  – Widespread availability
  – Ease of performance
  – Relatively low cost (compared to MR)

• Attenuation: metal/calcification > soft tissue/water > fat > air
Patient 1

This patient with a history of lung cancer was referred for CT to assess for recurrence.

Other than the large cancer mass not seen on this cut........

..this patient had another finding seen incidentally on this cut at the level of the right and left atria.

Can you see it?
Patient 1

Zoom views of CT soft tissue window show a non-enhancing, smoothly marginated, dumbbell-shaped, homogenous, fat-attenuation mass confined to the interatrial septum with some space occupation within the SVC/right atrial confluence. The absence of collaterals indicates no obstruction to flow.

Landmarks: left atrium, right pulmonary artery, right ventricle, left ventricle
Patient 1: Lipomatous Hypertrophy of the interatrial septum (LHIS)

- Usually discovered incidentally on CT.
- Interatrial fetal (brown) fat is normal.
- Upper limits of normal fat thickness anterior to fossa ovalis = 4.6 mm, posterior = 9.9 mm.
- This patient measured 6.4 mm (ap) anterior and 16.9 mm (ap) posterior.
- No association with venous stenosis or atrial occlusion.
- However, LHIS has been reported to cause arrhythmias by disrupting of septal conduction pathways.
- LHIS associated with diffuse mediastinal lipomatosis (discussed later) in 50% of cases.

Patient 2

72 year-old woman with well-demarcated 1-2 cm “paratracheal” mass on routine CXR referred to CT for further characterization

1.5 cm “paratracheal mass” seen on both PA (left) and lateral (right) chest radiographs. This mass is located approximately 4 cm above the carina.

Do we need a CT?
**Patient 2**

Patient was referred for CT to better characterize the lesion.

Special attention to the trachea *(normal this cut)* and paratracheal spaces *(also normal this cut)*.

Starting at the apices and scrolling caudad………

..what and where is this *(not normal!)*?

Let’s take a closer look.
Patient 2

A round, well-defined 1.0 cm mass is seen arising from the lateral wall of the luminal trachea.

Attenuation values of –50 through –150 indicate a predominantly fatty lesion, without significant soft tissue (other than a few fibrous septae) or calcificed element, making a diagnosis of lipoma most likely.
Multiplanar 2D reformation and 3D reconstructions confirm the presence of an endoluminal tracheal mass.

Extent of lesion and degree of narrowing are well visualized.
PATIENT 2: VIRTUAL TRACHEOBRONCHOGRAPHY

Passing around the lipoma

Start here superior to the lipoma

Above the lesion

Once inferior to the lesion, the bifurcation can be seen to look like E.T.
Patient 2: Lipoma

- Lipomas are uncommon mediastinal tumors.
- They are well defined, may be encapsulated, and are generally homogeneous.
- If the mass is inhomogeneous and contains areas of soft tissue attenuation or is poorly defined, an alternative diagnosis of liposarcoma should be entertained.
- Lipomas of the mediastinum are very rare.
- Lipomas of the trachea or bronchi are even more rare.
- Lipomas are benign and usually too soft to cause obstruction of vessels or soft tissue, however in the trachea, once occupying 75% of diameter will cause symptoms of stridor and asthma. Thus, this one will be removed.

Image from www.bioscience.org/atlasts/tumpath/ musbone/softtiss/3/1.jpg
Patient 3

6 month follow up of a small, <1.0 cm pulmonary nodule.

Soft tissue survey beginning at the lung apices and scrolling caudad reveals a fat-containing pedunculated lesion within the confluence of the rt internal jugular and rt subclavian veins, extending into the right brachiocephalic vein.
Patient 3: Intravascular lipoma of the right brachiocephalic vein

Attenuation level and homogeneity is consistent with the rare intravascular lipoma.

MRI/A was recommended and showed patent vessels with no lesion within or around the SC or BC/IJ veins.

Further workup, including repeat CT, MRA and new venogram are being considered.

Leiomyosarcomas and angiosarcomas are reported to occur in the SVC and IVC.

The CT findings could be a “fake-out from volume averaging.

Intravascular lipoma of the central veins

- Rare (0.5% of routine CT scans of the torso) tumors usually found incidentally, as in this case.
- Usually arise in the IVC.
- Usually DON’T cause obstruction but have been reported to cause a SVC syndrome in one patient, which was resolved when the patient had the lipoma surgically removed.

Image from BIDMC PACS.
Patient 4

47 year old 1 year s/p renal transplant with clinical ascites and decreased breath sounds on right. CT torso ordered for assessment.

CT of chest shows large right effusion containing a low attenuation finger projection anterior to the right ventricle.

Is this air in lung or fat?

Let’s view through a lung window....
Lung windows show that what was previously low attenuation on soft tissue windows (as fat and air are), is now higher attenuation than air in lung. This, in addition to pixel survey with HU density ranging: -75 to -165, shows this to be a little excess pericardial fat pad deposition, a normal variant. Note: the fat pad contains no soft tissue density.
Patient 5

Patient returns for f/u
Lung nodule 9-24-02

(This lesion is not really in the mediastinum, but it may have appeared so on PA CXR -Let’s pretend)

Most important thing for the radiologist to do now is to OBTAIN PRIOR FILMS!

Comparing the nodule to exam dated 5-15-01, the resident found this lesion to be not only stable, but also fat containing by pixelgram (surprise!).
Patient 5: Hamartoma

- 7% of all resected lung nodules are hamartomas
- CT findings suggesting hamartoma:
  - Smooth, well-defined boundaries.
  - Size 2.5 cm or less.
  - Containing focal fat or fat with calcification (see pixel gram). Fat (see pixel gram) not always visually obvious: obtain a pixel gram.

- Conservative follow up is recommended for lesions that satisfy CT criteria for hamartoma.

Pixel gram values:

-45  89  98  -14  420  435
-25  57  57  78  400  400
-68  -79  -100  -150

From Glazer et al. CT of fatty thoracic masses. AJR 1992;159:1181-87.
DDX: Fat-containing mediastinal masses

MASSES

Benign
- Mature teratoma
- Thymolipoma
- Lipoma
- Hamartoma

Malignant
- Liposarcoma

FOCAL: NON NEOPLASTIC
- Pericardial fat pad
- Fatty-replaced lymph nodes
- Hernia
- Mediastinal panniculitis
- LHIS

DIFFUSE CONDITIONS
- Mediastinal lipomatosis
- Whipple disease
Mature teratoma

- Benign, well differentiated germ cell tumor
- From 2+ embryonic germ layer
- **Anterior mediastinum**, 70% unilateral, in thymus.
- Patients within the first 4 decades.
- 70% Patients symptomatic at diagnosis: chest pain, cough, URI, palpitations, hemoptysis, stridor.
- Contrast-enhanced CT reveals a heterogeneous multilocular cystic mass containing soft tissue, fluid, fat and calcium (this case had no calcium) attenuation.
- The classic **fat-fluid level** is rare but pathognomonic when present.

Thymolipoma

- Extremely rare, benign neoplasm of the thymus.
- Adipose and thymic tissue.
- Anterior (inferior) mediastinum
- Mean age 26 years, however to 70
- 50% sx: URI, CP, dyspnea
- CXR often mimics cardiomegaly (PA) or elevated hemidiaphragm (lateral)
- CT findings demonstrate a large mixed fat and soft tissue density mass adjacent to the mediastinum which may conform to the shape of adjacent mediastinal structures.
- Must be connected to thymus.

Images from www.visn1.med.va.gov/boston/radiology/radcases/case82i3.jpg
Fat-replaced lymph nodes

Unenhanced CT demonstrated **central fibrofatty replacement** of a mediastinal lymph nodes can normally occur as a result of previous benign reactive inflammatory disease.

*Image from Boiselle PM, Rosado-de-Christenson ML. Fat attenuation lesions of the mediastinum. JCAT 2001; 25(6): 881-889.*
Herniation of abdominal fat

- PA CXR demonstrates a large, well marginated right cardiophrenic angle mass (white arrows) containing air-filled bowel (black arrow).
- Herniations of abdominal fat can be diagnosed on CT by fat attenuation and presence of linear opacities within the fat: omental vessels.
- Morgagni foramen (anterior) herniations (here) occur in right cardiophrenic angle.
- Bochdalek (posterior) and traumatic herniations occur on left (liver guards on the right).

Boiselle PM, Rosado-de-Christenson ML. Fat attenuation lesions of the mediastinum. JCAT 2001; 25(6): 881-889.
Mediastinal lipomatosis

• Benign entity of increased collections of unencapsulated normal fat are present in the anterior superior mediastinum, cp angles, paraspinal areas and heart.
• Usually a result of Cushing’s syndrome, obesity, exogenous steroids, or idiopathy.
• PA film demonstrates mediastinal widening.
• Unenhanced chest CT (mediastinal window) reveals mediastinal widening secondary to excessive fat.

Images: http://www.meddean.luc.edu/lumen/meded/medicine/pulmonar/images/xray/11cl.jpg
Summary

An array of surgical and non-surgical pathologies occur in the mediastinum and thorax. The presence and pattern of fat attenuation on CT will allow the radiologist to narrow the differential diagnosis of such focal and diffuse conditions.
References

• Meaney JFM et al. CT Appearance of lipomatous hypertrophy of the interatrial septum. *AJR* 1996; 168: 1081-84.
• McCarthy MJ and Rosado-de-Christensen ML. Tumors of the trachea. *J Thor Imag* 1995; 10(3): 180-98
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