

Non-neoplastic mimickers of primary lung cancer

Poster No.: C-0819
Congress: ECR 2010
Type: Educational Exhibit
Topic: Chest
Authors: C. Paulino, B. Graça, M. Seco, F. Cavalheiro, L. Teixeira, M. Gonçalves, F. Caseiro-Alves; Coimbra/PT
Keywords: pseudotumors, lung neoplasms, nodule
DOI: 10.1594/ecr2010/C-0819

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org

LEARNING OBJECTIVES

- To illustrate the radiological features of the most frequent pseudotumoral lung conditions.
- To describe the characteristics that may be useful in the differential diagnosis versus primary lung cancer.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

Background

BACKGROUND

A variety of nonneoplastic conditions can radiologically resemble primary lung cancer. The characteristic imaging features of these *pseudotumoral* conditions (*nodular/mass lesions that are not true neoplasms*) may provide key information, which direct the radiologist to the correct diagnosis.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

Imaging findings OR Procedure details

LUNG PSEUDOTUMORS

Infection disorders

- INFECTIOUS GRANULOMA (TUBERCULOMA, HISTOPLASMOMA)
- ROUND PNEUMONIA
- LUNG ABCESS
- SEPTIC EMBOLUS

Inflammatory conditions

- ORGANIZING PNEUMONIA
- SARCOIDOSIS
- REUMATOID NODULE
- WEGENER GRANULOMATOSIS
- EXOGENOUS LIPOID PNEUMONIA

Congenital lesions

- ARTERIOVENOUS MALFORMATION
- SEQUESTRATION
- BRONCHOGENIC CYST

Miscellaneous entities

- BRONCHOCELE
- LUNG INFARCT
- ROUND ATELECTASIS
- CISURAL PLEURAL EFFUSION
- HEMATOMA

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

TUBERCULOMA

- Tuberculoma is a round or oval granuloma caused by acid-fast bacilli with a wall lined by granulomatous inflammatory tissue or encapsulated by connective tissue. The central portion of the tuberculoma shows caseation necrosis.
- *Tuberculoma may develop in primary tuberculosis but are much more common in postprimary disease.* In postprimary tuberculosis, a tuberculoma is the main or only abnormality seen on chest radiographs in approximately 5% of patients.
- Tuberculomas can be solitary or multiple and are defined as round or oval, sharply marginated lesions usually measuring between 0.5–4.0 cm. Satellite lesions are seen in up to 80% of cases. Calcification is found in 20%–30% of tuberculomas and is usually nodular and diffuse.

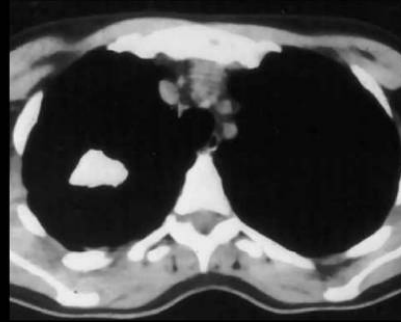
Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

TUBERCULOMA



Figure 1. 40 year-old patient with tuberculosis in the past. Chest film (a) shows a homogeneous nodule with high density in the right upper lobe. CT (b) confirms a well defined and totally calcified nodule with 4 cm.



Complete or central calcification within a nodule is specific for a healed granuloma from tuberculosis or histoplasmosis.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

TUBERCULOMA

Four patterns of calcification can be used to predict the presence of a benign lesion:

1. Homogeneous calcification;
2. Dense central ("bul's eye") calcification;
3. Concentric rings of calcium ("target" calcification);
4. Conglomerate foci of calcification involving a large part of the nodule ("popcorn" calcification).

Indeterminate patterns of calcification which may be seen in benign or malignant lesions:

1. Stippled calcification;
2. Eccentric foci of calcification.

Approximately 10% of malignant nodules contain calcification on CT. Calcium in a tumour may reflect dystrophic calcification, engulfing of a pre-existing granuloma, or calcification of the tumour itself (mucinous adenocarcinoma or osteogenic sarcoma).

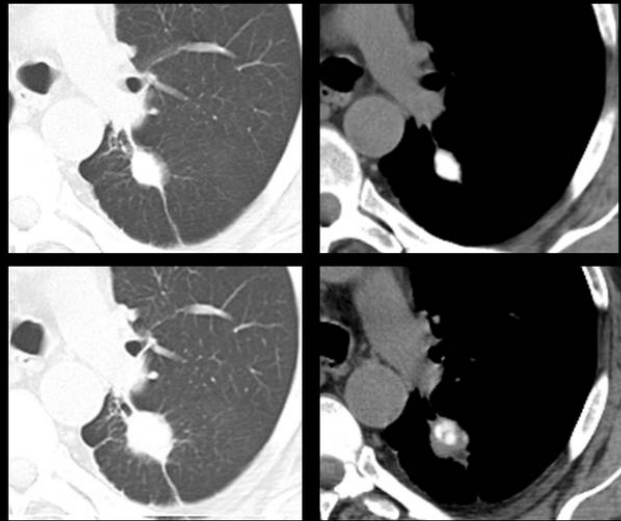


Figure 2. CT in 2006 (a and b) shows a totally calcified nodule in the left lower lobe, consistent with a healed granuloma. There is also a pleural tail, a nonspecific finding that can be seen in peripheral granulomas. In the follow-up CT two years later (c and d), the nodule was larger and had a soft tissue component. This is an example of a carcinoma engulfing a pre-existing granuloma. In this situation, the calcification will be eccentric in the nodule.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ROUND PNEUMONIA

- Occasionally, infection is manifested as a spherical focus of consolidation that simulates a mass (round pneumonia).
- Round pneumonia is more common seen in pneumonia caused by *Streptococcus pneumoniae*.
- ***This pattern is seen more commonly in children than in adults.*** In fact, such an appearance is not uncommon at certain stages of pneumonia in children.
- *Pulmonary abscess has a similar appearance but usually contains central cavitation with air-fluid levels.*

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ROUND PNEUMONIA

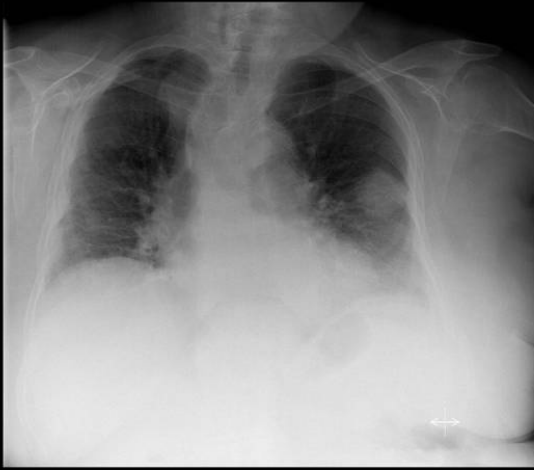


Figure 3. Round pneumonia due to *Streptococcus pneumoniae*. Chest radiograph (a) shows a round area of consolidation mimicking a mass in the left lung.

The most common pulmonary “mass” in children is a pseudomass caused by a spherical pneumonia.

III-defined “pseudomass”.

Symptoms of infection (fever, chills).

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG ABSCESS

- Lung abscesses usually develop as a complication of a bacterial pneumonia and can be solitary or multiple.
- A lung abscess represents a localized infection that undergoes tissue destruction and necrosis.
- A lung abscess appears as a mass of central low density within a pneumonic infiltrate or rounded opacity. Contrast administration more clearly demarcates the hypodense center from the enhancing rim. The inner wall of an abscess varies from smooth to shaggy and irregular, and maximum wall thickness usually ranges from **5 to 15 mm**. Sometimes the outer wall is obscured by surrounding consolidation. *When a communication with the tracheobronchial tree is present, cavitation and an air-fluid level may be evident.*

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG ABSCESS

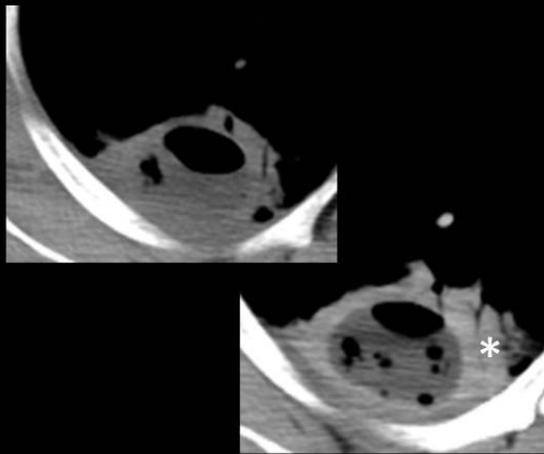


Figure 4. 57 year-old diabetic patient, with fever, cough, dyspnea and foul expectoration. Axial CT images show a fluid-filled abscess on the right lung with small amounts of air inside it. After contrast administration (b), a enhancing wall is visible and there is surrounding consolidated lung (*), a clue to the inflammatory etiology of this lesion.

*An abscess may have a similar appearance to a necrotic tumor. **Wall thickness > 15 mm suggests tumor.***

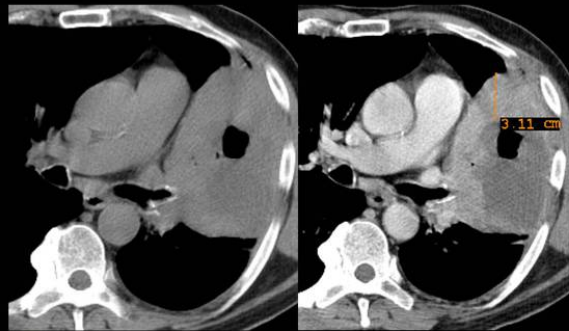


Figure 5. Necrotic adenocarcinoma. There is a mass in the left lung with fluid attenuation and gas in eccentric location. This could mimetize an abscess, but the enhancing wall is too thick (3,11 cm) and the eccentric location of fluid and gas is also atypical for abscess. The maximum wall thickness of an abscess usually ranges from 5 to 15 mm.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

SEPTIC EMBOLUS

- Thromboembolic material can arise in septic conditions and cause the occlusion of small pulmonary arteries. Septic emboli may originate from an infected catheter, abscess, endocarditis, or pulmonary or urinary infection.
- CT usually shows 1-3 cm peripheral poorly marginated nodular or wedge-shaped opacities in various stages of cavitation. The detection of a feeding vessel confirms the hematogenous origin of the lesion (*feeding vessel sign* found in 60-70% of patients). The typical appearance is that of disseminated bilateral lesions that are mainly located in the lower lobes (due to gravity and blood flow), which may change in number or appearance (size or cavitation) from day to day. There may be accompanying pericardial or pleural effusion; often complicated by empyema.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

SEPTIC EMBOLUS



Figure 6. Lung window CT image (a) shows peripheral poorly margined nodular opacities in the lower lobes. Abdominal CT of the same patient shows a right psoas abscess (b). Soft-tissue window (c) shows concomitant pleural and pericardial effusion.



Septic foci have less distinct margins than metastases and often appear as wedge-shaped opacities based on the pleura, some of which are cavitating. May change in number or appearance from day to day.

Associated with IV drug abusers, alcoholism, skin infection, peripheral septic thrombophlebitis.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ORGANIZING PNEUMONIA

- Organizing pneumonia (OP) is a disorder characterized by the widespread deposition of granulation tissue within peribronchiolar airspaces and bronchioles.
- Most cases of OP are idiopathic (*cryptogenic organizing pneumonia*), but a number of conditions have been associated with this disorder.
- The most common CT findings of organizing pneumonia consist of bilateral areas of patchy air-space consolidation, often subpleural and/or peribronchial, with or without ground-glass opacities, typically in mid and lower lung zones. However, these findings are seen in only approximately 60% of patients.
- Other less specific imaging patterns can be encountered and include focal organizing pneumonia, characterized by a solitary pulmonary mass with spiculated or irregular margins that can closely resemble lung cancer.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ORGANIZING PNEUMONIA

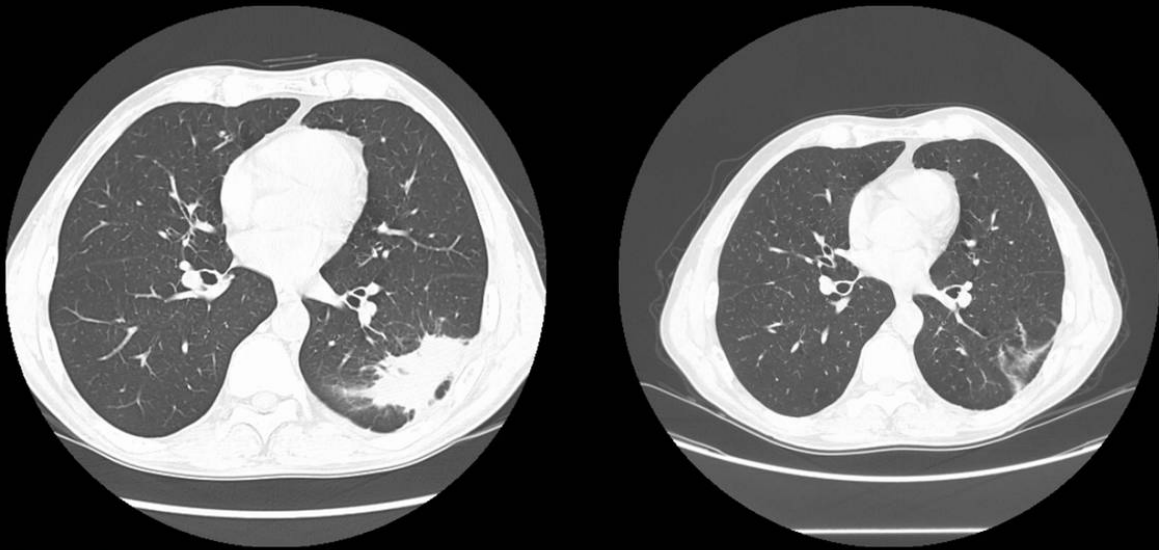


Figure 7. Axial HRCT shows a left lower lobe mass with spiculated margins (a). On biopsy this lesion proved to be organizing pneumonia. Axial HRCT of the same patient after treatment with corticosteroids (b) showing almost complete resolution of the lesion.

OP tends to wax and wane and responds to steroid treatment;

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

SARCOIDOSIS

- Sarcoidosis is a multisystem granulomatous disease of unknown etiology characterized histologically by noncaseating granulomas that may progress to fibrosis.
- Mediastinal and bilateral symmetric hilar lymph node enlargement is found in 80% of patients with sarcoidosis.
- The lung is involved radiographically in only 40 to 50% of patients with sarcoidosis. The most common parenchymal abnormality is bilateral symmetric reticulonodular opacities predominantly in a peribronchovascular and subpleural location, typically in the mid and upper lung zones.
- In approximately 10% of patients, the coalescence of granulomas can produce nodular or masslike opacities. These masses can be quite large and typically have a sharp margin. Air bronchograms are often demonstrated on CT and HRCT.

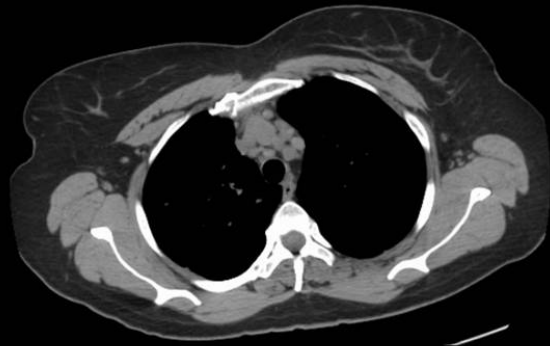
Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

SARCOIDOSIS



Figure 8. Lung window CT image (a) shows a nodular opacity in the right lower lobe. There are also reticulonodular opacities in the middle lobe. Soft-tissue window CT image (b) shows concomitant mediastinal adenopathies.



*Nodular or masslike sarcoidosis may mimic lung cancer. **The presence of reticulonodular opacities elsewhere in the lung or concomitant symmetric hilar and mediastinal lymph node enlargement provide important clues to the diagnosis.***

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

REUMATHOID NODULE

- Rheumatoid arthritis produces a chronic arthritis of peripheral joints.
- Extra-articular manifestations are seen in up to 75% of patients.
- *The pleuro-pulmonary manifestations of rheumatoid disease typically follow the onset of joint disease. However, in up to 15% of patients, pleuropulmonary involvement precedes the joint disease.*
- Pleuritis is the most common thoracic manifestation of rheumatoid disease and is found in 20% of patients.
- The most common radiographic manifestation of parenchymal involvement is an interstitial pneumonitis and fibrosis. This begins as an alveolitis that is seen radiographically as fine reticular or ground-glass opacities with a lower zone predominance. There is gradual progression to end-stage pulmonary fibrosis with the development of a bibasilar medium or coarse reticular or reticulonodular pattern (honeycombing).

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

REUMATHOID NODULE

- Less common parenchymal manifestations of rheumatoid disease include lung nodules, seen in < 5% of patients. Necrobiotic (rheumatoid) nodules in the lung can produce peripheral well-defined opacities on chest radiographs that are indistinguishable from the subcutaneous rheumatoid nodules seen on the extensor surfaces of the elbows and knees in these patients. Nodules can be single or multiple, ranging from 5 mm to 7 cm. The lung nodules commonly evolve into thick-walled cavities, which tend to wax and wane in parallel with the flares of arthritis.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

REUMATHOID NODULE

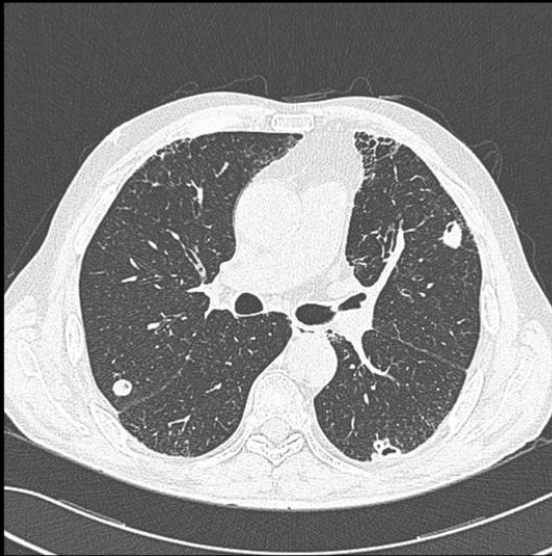


Figure 9. Axial CT shows peripheral well-defined nodules with areas of cavitation. There are findings of concomitant fibrosis in anterior subpleural location in the upper lobes.

The pleuro-pulmonary manifestations of rheumatoid disease typically follow the onset of joint disease. Hand films or findings of distal clavicle erosions provide important clues to the diagnosis.

Rheumatoid nodules commonly evolve into thick-walled cavities, which tend to wax and wane in parallel with the flares of arthritis.

Pleural disease (thickening or effusion) and interstitial pneumonitis and fibrosis can be concomitant findings.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

WEGENER GRANULOMATOSIS

- Wegener granulomatosis is a systemic autoimmune disorder characterized pathologically by a necrotizing granulomatous vasculitis involving the upper and lower respiratory tracts and kidneys. *The respiratory tract is affected in 100% of patients, with symptoms usually dominated by sinus and nasal mucosal involvement.* Renal involvement usually follows involvement of the respiratory tract and is seen in almost 90% of patients.
- The characteristic lesions in the lungs are discrete nodules or masses of granulomatous inflammation with central necrosis and cavitation.
- The lesions involve pulmonary vessels, accounting for the high incidence of central necrosis and for the occasional presentation with pulmonary hemorrhage.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

WEGENER GRANULOMATOSIS

- The characteristic chest radiograph features of lung involvement in Wegener granulomatosis are multiple sharply marginated nodules or masses, range in size up to 10 cm; solitary lesions are seen in up to one-third of patients. On CT, lung nodules can be sharp or ill-defined from surrounding hemorrhage (*halo* sign) and tend to be bronchocentric or subpleural and peripheral. Irregular, thick-walled cavitary lesions are seen in 50% of patients during the course of disease.
- Tracheal or bronchial lesions may be present and are usually best appreciated on CT, where they appear as calcified mucosal or submucosal deposits, producing irregular narrowing of the airway lumen. Endobronchial lesions may produce distal atelectasis. Pleural effusion from pleural involvement is not uncommon.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

WEGENER GRANULOMATOSIS

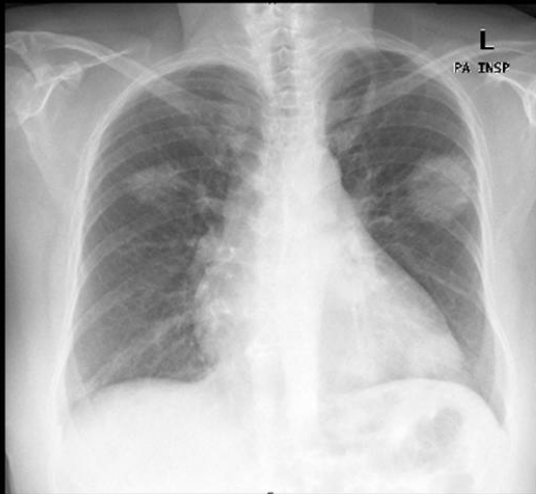
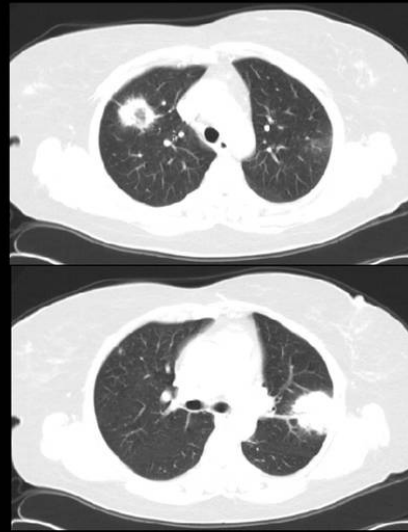


Figure 10. Chest radiograph and axial CT show sharply marginated nodules located in the periphery of the lung. The nodule in the right upper lobe is cavitated. The patient is a 56 year-old woman with chronic renal disease.



Multiple cavitary nodules and large airway narrowing.

Systemic vasculitis: concomitant paranasal sinus or renal disease.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

EXOGENOUS LIPOID PNEUMONIA

- Exogenous lipoid pneumonia is a rare disorder caused by the aspiration of mineral, vegetable, or animal oils present in food, radiologic contrast media, or oil-based medications.
- Predisposing factors such as neuromuscular disorders or structural abnormalities of the pharynx and esophagus are frequently associated with this condition.
- At clinical examination, patients present with cough, dyspnea, mild fever, and chest discomfort.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

EXOGENOUS LIPOID PNEUMONIA

- *The most common locations for lipoid pneumonia are the dependent portions of the lungs.*
- **Chest radiographs** are usually nonspecific, demonstrating airspace consolidation, an irregular masslike lesion, or a reticulonodular pattern.
- The characteristic **CT** finding is *lung consolidation with fat attenuation (-35 to -75 HU)*. However, exogenous lipoid pneumonia can also manifest as a “crazy-paving” pattern of septal thickening and centrilobular interstitial thickening superimposed on ground-glass attenuation.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

EXOGENOUS LIPOID PNEUMONIA

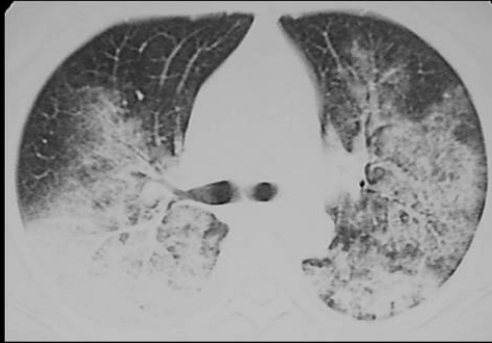
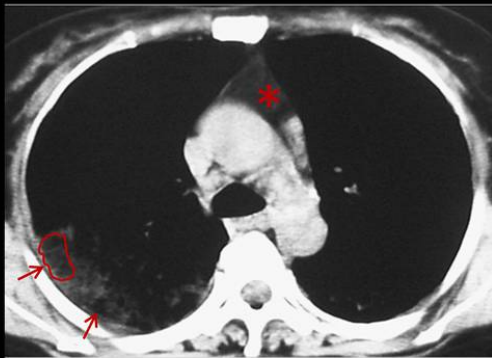


Figure 11. 47 year-old smoker, using oily nasal drops for his chronic sinusitis, presented with subacute dyspnea and abnormal chest radiograph. Lung window CT image (a) shows ill-defined parahilar ground-glass opacity and areas of consolidation in the posterior lung. Soft-tissue window CT image at the same level (b) shows areas of low attenuation (arrows) within the consolidation. This low attenuation is similar to the mediastinal fat (*).



Exogenous lipoid pneumonia can occasionally appear as poorly marginated focal masslike lesions that mimic pulmonary neoplasms. CT is well suited for making a definitive diagnosis when negative attenuation values are demonstrated within the mass, indicating the presence of lipid deposition.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ARTERIOVENOUS MALFORMATION

- Pulmonary arteriovenous malformations (AVMs) are abnormal vascular masses in which a focal collection of congenitally weakened capillaries dilates to become a tortuous complex of vessels fed by a single pulmonary artery and drained by a single pulmonary vein.
- AVMs can occur in isolation, be multiple, or be part of a systemic process where arteriovenous communications occur in the skin, mucous membranes, and other organs (*hereditary hemorrhagic telangiectasia* or *Rendu-Osler-Weber disease*).
- Pulmonary AVM usually appear as a smooth, sharply defined, round or elliptical nodule, most often located in the subpleural portions of the lower lobes. The lesion has feeding and draining vessels emanating from the mass and extending toward the hilum.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ARTERIOVENOUS MALFORMATION

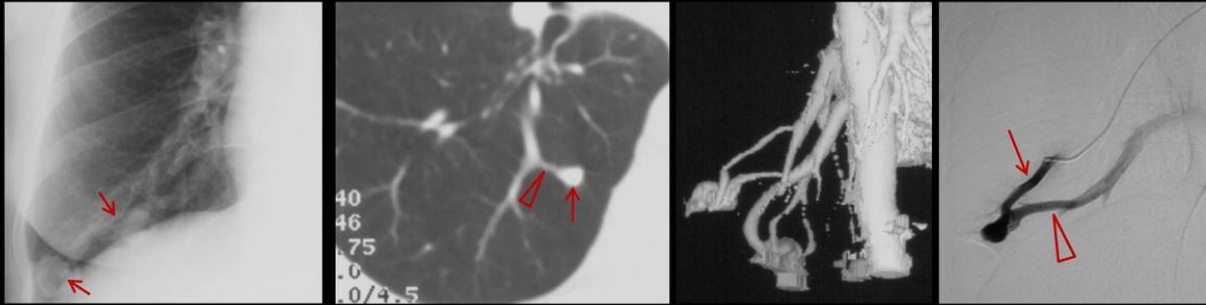


Figure 12. A 37 year-old patient with hereditary hemorrhagic telangiectasia has a chest radiography with some nodules in the right lung (a). Axial CT image (b) shows the feeding artery (arrowhead) of a small MAV (arrow). 3D reconstruction (c) shows the feeding and draining vessels. Pulmonary arteriography (d) of another patient showing a simple arteriovenous malformation supplied by a single artery (arrow) and drained by a single vein (arrowhead).

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ARTERIOVENOUS MALFORMATION

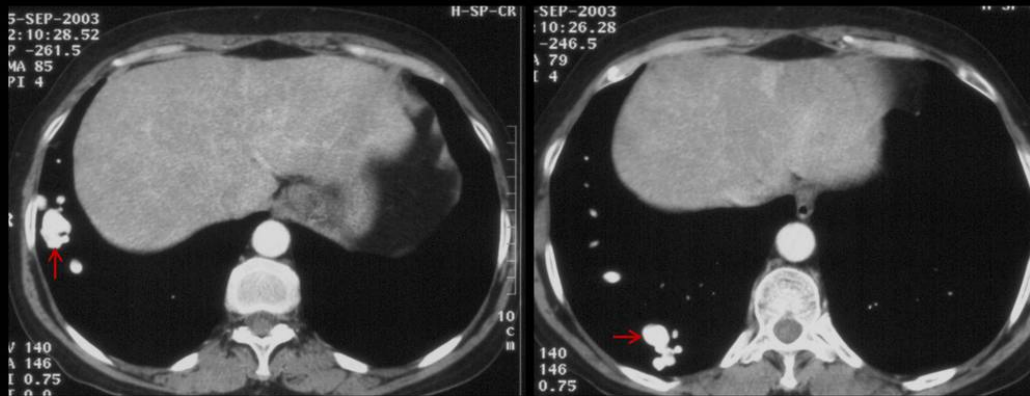


Figure 13. Multiple AVMs in another patient with Osler-Weber-Rendu syndrome. Arteriovenous fistulas (arrows) characterized by a tangle of tortuous, dilated vessels that are seen as lobulated, serpiginous masses. With contrast injection, dense opacification of the fistulas is seen.

Pulmonary AVMs show rapid contrast opacification and washout, occurring in phase with opacification and washout of the main pulmonary artery and the right ventricle.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG SEQUESTRATION

- Pulmonary sequestration results from the independent development of a portion of the tracheobronchial tree that is isolated from the normal lung and maintains its fetal systemic arterial supply.
- Sequestration is divided into **intralobar** and **extralobar** forms.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG SEQUESTRATION

	INTRALOBAR	EXTRALOBAR
Frequency	Common (75%)	Uncommon (25%)
Age at presentation	Young adult	Neonate / Infant
Mode of presentation	Recurrent pneumonia	Asymptomatic
Associated congenital anomalies	Rare	Common (diaphragmatic eventration / hernia)
Location	<i>Left lower lobe (60%)</i> Right lower lobe (40%)	<i>Left lower lobe (90%)</i> Right lower lobe (10%)
Pleural covering	Within visceral pleura	Separate pleural layer
Imaging appearance	Homogeneous and well-defined mass lesion and/or cystic or multicystic air and fluid-filled lesion and/or hyperlucent and hypovascular region of lung	Homogeneous and well-defined mass lesion that may contain fluid-filled cystic areas
Arterial supply	Single vessel from peridiaphragmatic aorta	Multiple small systemic / pulmonary arteries
Venous drainage	Pulmonary veins	Systemic veins

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG SEQUESTRATION

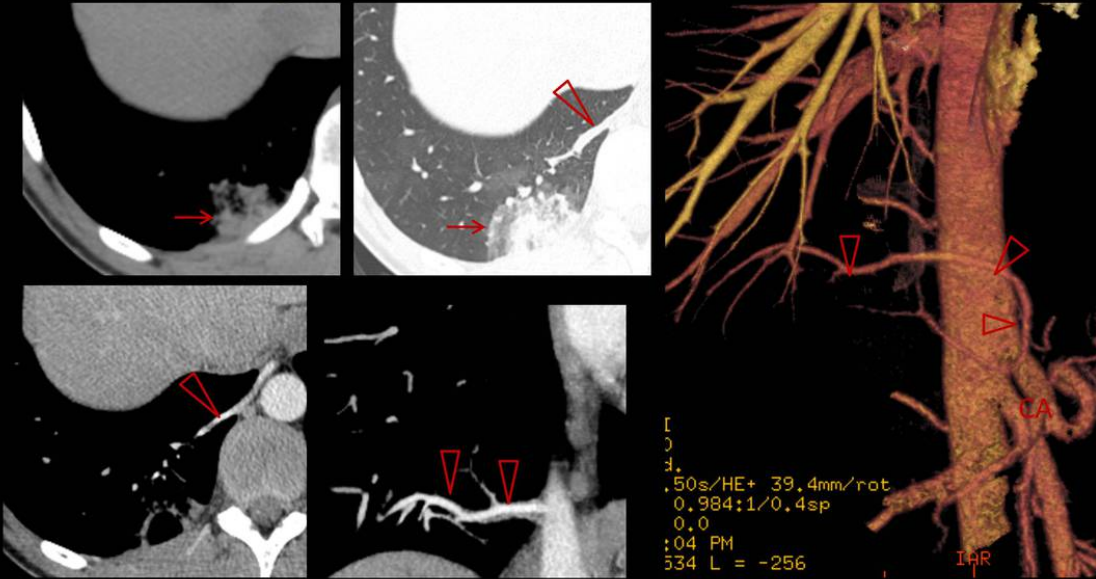


Figure 14. 33 year-old patient with recurrent hemoptysis. CT images show a consolidation / mass at the posterior basal segment of the right lower lobe (arrow) with a systemic feeding artery (arrowheads) arising from the abdominal aorta, just adjacent to the celiac axis (CA).

The definitive diagnosis is made by the demonstration of abnormal systemic arterial supply to the abnormal lung.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

BRONCHOGENIC CYST

- Bronchogenic cysts are thought to result from abnormal budding of the developing tracheobronchial tree with separation of the buds from the normal airways.
- Bronchogenic cysts may be **mediastinal** (80-90%), **intrapulmonary** (typically in the *lower lobes*), or, less frequently, in the **lower neck**.
- Two-thirds of the patients are symptomatic; symptoms are due to compression of the trachea or bronchi, or infection, which leads to cough, wheezing, stridor, dyspnea, cyanotic spells, and pneumonia.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

BRONCHOGENIC CYST

- The cysts are filled with serous or mucous fluid, so usually appear as a single smooth, round or elliptic, water-density mass in **chest radiographs**. Intrapulmonary cysts may communicate with the tracheobronchial tree and then may show air or an air-fluid level.
- On **CT**, the cysts appear as a well-defined, thin-walled mass of fluid density (0 to 10 HU) that fails to enhance following intravenous contrast administration.
- On **MR**, T1-weighted MR images show that the intrinsic signal intensity ranges from low to high depending on cyst contents. On T2-weighted MR images, the cysts are typically high in signal intensity.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

BRONCHOGENIC CYST

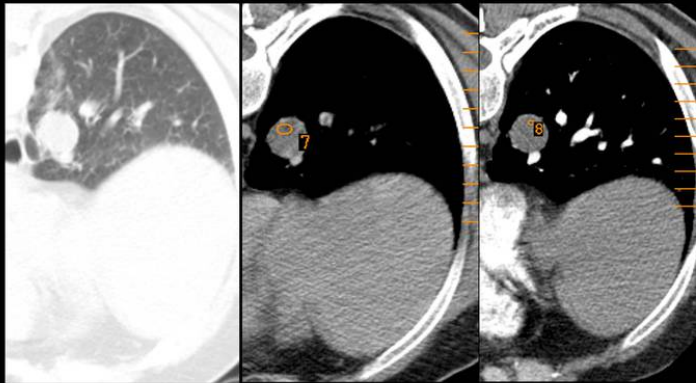


Figure 15. Smoker patient that was referred for CT guided lung biopsy. Axial CT images (note the patient is in prone position) show a sharply margined round nodular opacity in the right lower lobe (a). The nodule has fluid attenuation (b) and there is no enhancement after contrast administration (c).

Bronchogenic cyst contents can be serous, hemorrhagic, or highly viscous and gelatinous because of its high protein content. *High CT numbers (> 40 HU) suggesting a solid mass can be seen when the cyst is filled with mucoid material, milk of calcium, or blood. An important clue to the diagnosis can be their lack of enhancement following intravenous contrast infusion.*

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

BRONCHOCELE

- Both congenital and acquired abnormalities may cause ***mucoïd impaction*** of the large airways that often manifests as tubular or branching opacities that resemble fingers – the so-called *finger-in-glove sign* – radiating from the hilum toward the periphery of the lung.
- The *congenital conditions* in which this sign most often appears are segmental bronchial atresia and cystic fibrosis. The sign also may be observed in many *acquired conditions*, include *inflammatory and infectious diseases* (allergic bronchopulmonary aspergillosis, broncholithiasis, and foreign body aspiration), *benign neoplastic processes* (bronchial hamartoma, lipoma, and papillomatosis), and *malignancies* (bronchogenic carcinoma, carcinoid tumor, and metastases).

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

BRONCHOCELE

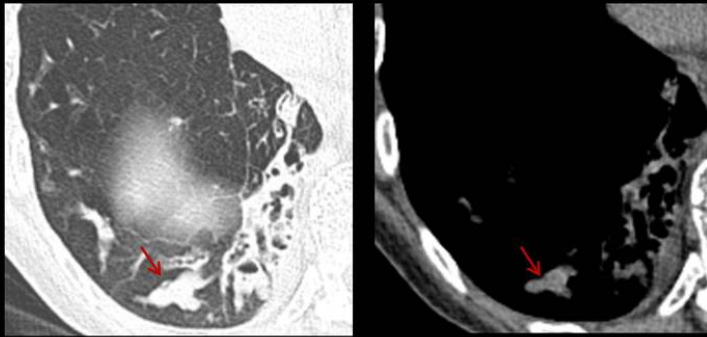


Figure 16. 37 year-old patient with several episodes of broncho-pulmonar infections. Axial CT images show several bronchiectasis in the right lower lobe and a branching tubular opacity (arrow),

*Mucous plugs mimicking the appearance of a lung nodule (or nodules) may be seen in a variety of conditions. **Usually, the characteristic branching appearance of the mucoid impactation (resembling gloved fingers or the shape of the letters V or Y) allows it to be distinguished from other causes of a lung nodule.***

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG INFARCT

- Less than 10% of all embolic episodes result in lung infarction. Collateral bronchial arterial and retrograde pulmonary venous flow prevent infarction in most patients. Infarction from embolism occurs with greater frequency in patients with underlying heart failure because of their limited collateral bronchial arterial flow to the ischemic region.
- Radiographic features that suggest infarction include the presence of a *small pleural effusion* and the development of a *pleura-based wedge-shaped opacity (Hampton hump)*. This opacity, typically found in the posterior or lateral costophrenic sulcus of the lung, is wedge-shaped, homogeneous, and lacks air bronchograms. The blunted apex of the wedge points toward the occluded feeding vessel, while the base is against the pleural surface. This wedge-shaped opacity is often obscured by surrounding areas of hemorrhage in the early phases following infarction and becomes more obvious with time as the peripheral areas of hemorrhage resolve (*melting snowball sign*). Infarcts resolve over the course of several weeks or months and usually leave a residual linear parenchymal scar (*Fleischner line*) and/or localized pleural thickening.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

LUNG INFARCT



Figure 17. 70 year-old patient with dyspnea and right sided pleuritic pain. Soft-tissue and lung window CT images before contrast administration ((a) and (b)) show a wedge-shaped opacity in the peripheral lung, contacting the pleural surface and associated with surrounding ground-glass opacity (halo sign), consistent with adjacent hemorrhage. Angio-CT (c) shows a pulmonary embolus in the lateral segmental artery of the medium lobe (arrows). So this is a pulmonary infarction in a patient with pulmonary embolism.

On CT, pulmonary infarctions are characterized by the following features: a wedge-shaped opacity (sometimes with a truncated apex); contact with the pleural surface; convex borders; a linear opacity directed from the apex of the density toward the hilum (i.e., its feeding vessel); scattered areas of low attenuation (necrosis) within the lesion; and a halo sign due to adjacent hemorrhage.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ROUND ATELECTASIS

- Rounded atelectasis is an uncommon form of atelectasis in which the collapsed lung forms a round mass in the lower lobe.
- This condition is most closely associated with asbestos-related pleural disease but may be seen in any condition associated with an exudative (proteinaceous) pleural effusion. The process develops when pleural adhesions form in the resolving phase of a pleural effusion and cause the adjacent lung to roll up into a ball as it re-expands.
- The CT appearance of round atelectasis is characteristic. The round or wedge-shaped mass forms an acute angle with the pleura and is seen adjacent to an area of pleural thickening, usually in the inferior and posterior thorax. A curvilinear bronchovascular bundle or “comet tail” is seen curving between the hilum and the apex of the mass. The atelectatic lung enhances following intravenous contrast administration.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ROUND ATELECTASIS

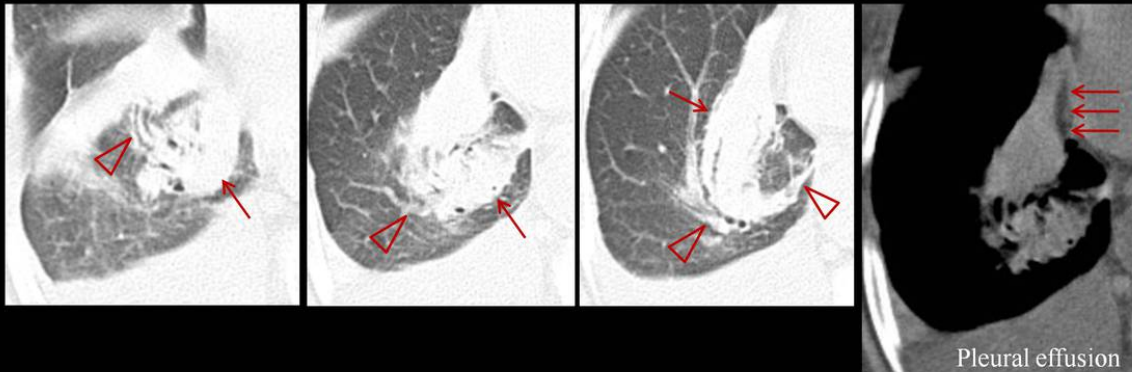


Figure 18. Typical rounded atelectasis associated with pleural effusion. CT scans of three adjacent levels, (a), (b) and (c), show an elliptical opacity (arrows), which has significant contact with the mediastinal pleural surface. Vessels and bronchi curve into the edge of the lesion – “comet-tail sign” (arrowheads). In cine mode it was perceptible a whorled appearance, produced by the crowding of the bronchovascular bundle. Soft-tissue window CT image (d) shows that the opacity has soft tissue attenuation with significant contact with the mediastinal pleura (arrows).

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

ROUND ATELECTASIS

To suggest the diagnosis of rounded atelectasis on CT, the opacity should be:

- ✓ *round or elliptical;*
- ✓ *associated with an ipsilateral pleural abnormality, either effusion or pleural thickening;*
- ✓ *peripheral in location, having significant contact with the abnormal pleural surface;*
- ✓ *associated with curving of pulmonary vessels or bronchi into the edge of the lesion ("comet-tail sign");*
- ✓ *associated with volume loss in the affected lobe;*
- ✓ *associated with significant enhancement following the intravenous injection of contrast agents.*

When the characteristic CT findings are seen in a patient with a known history of pleural disease, the appearance is diagnostic and no further evaluation is necessary. However, if any of the above criteria are not satisfied, the lesion should be biopsied to exclude malignancy.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

CISURAL PLEURAL EFFUSION

- Pleural fluid may extend into the interlobar fissures, producing characteristic findings.
- Fluid loculated between the leaves of visceral pleura within an interlobar fissure results in an elliptic opacity oriented along the length of the fissure.
- These loculated collections of pleural fluid are termed “pseudotumors” and are most often seen within the minor fissure on frontal radiographs in patients with **congestive heart failure**. The tendency for these opacities to disappear rapidly with diuresis has led to the term “*vanishing lung tumor*”.
- Although a characteristic appearance on plain radiographs is usually sufficient for diagnosis, the CT demonstration of a localized fluid collection in the expected location of the major or minor fissure is confirmatory.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

CISURAL PLEURAL EFFUSION

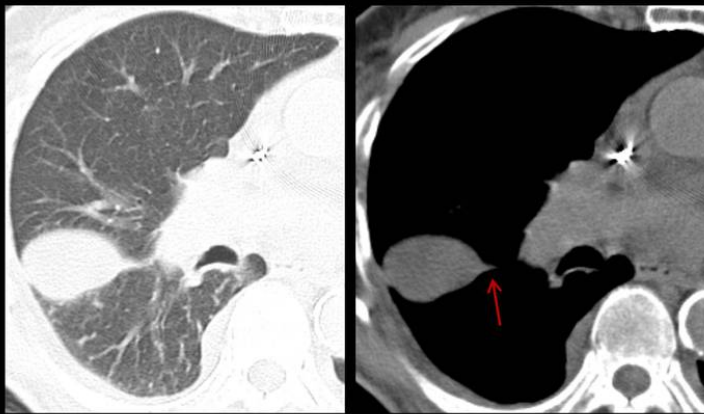


Figure 19. 68 year-old patient with congestive heart failure presented with a mass on chest radiography. Lung window CT image shows an apparent parenchymal mass in the right lung. Analysis of sequential soft-tissue window CT images showed a lenticular shape and the relationship of the opaque mass to the plane of the fissure. A beak is visible medially (arrows) and the pseudolesion is of homogeneous fluid attenuation.

A focal or loculated collection of pleural fluid in a major or minor fissure can have a confusing appearance on CT images and can be misinterpreted as a parenchymal mass. Careful analysis of sequential images usually will confirm the relationship of the opaque mass to the plane of the fissure. If the abnormality is of fluid density the diagnosis becomes more likely. The edges of the mass may taper to conform to the fissure, forming a beak.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

HEMATOMA

- Injury to lung parenchyma occurs after blunt or penetrating trauma. Typically a combination of contusion, hemorrhage and laceration is present.
- **Pulmonary lacerations** are tears in the lung parenchyma, resulting from disruption of alveoli leading to a radial retraction of parenchyma. In blunt trauma, linear tear results in a spherical hole in the lung parenchyma. If the laceration fills with blood, a spherical **hematoma** forms. If it fills with air, a **traumatic air cyst** forms. If both blood and air are present, an *air-fluid level* may be seen.
- Lacerations occur in four distinct locations, depending upon the mechanism of injury: lacerations will conform to the tract of a penetrating object; small peripheral lacerations occur from rib fractures; large central pulmonary lacerations occur after forced chest compression against a closed glottis; paravertebral lacerations occur as a shearing injury when lung is squeezed over the spine during an anterior/posterior compression.
- Lacerations are quite variable in size, from < 1 cm to up to 20 cm and can be multiple.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

HEMATOMA

- Lacerations are present at time of initial injury but may not become apparent for hours or even days after trauma, as can be obscured by surrounding atelectasis, contusion, and hemorrhage. Lacerations can change their appearance over days to weeks, initially being air-filled but becoming blood-filled, or vice-versa. Lacerations heal over several weeks leaving only minimal scarring.



Figure 20. Axial CT in a patient with history of chest trauma shows areas of contusion. In the right upper lobe there is also a laceration filled with blood and air – an air-fluid level is apparent.

Hematomas can appear as spiculated lung masses as they heal, mimicking malignancy.

Trauma history.

Resolves over time, sometimes called vanishing lung tumor.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

Conclusion

CONCLUSION

Lung pseudotumors are a polymorphous category of lesions in which a correct non-invasive diagnosis may be difficult to achieve. Awareness of the imaging spectrum of pseudotumoral lung conditions can increase the accuracy in diagnosing these lesions and in differencing them from primary lung carcinoma.

Fig.

References: C. Paulino; Serviço de Imagiologia, Hospitais da Universidade de Coimbra, Coimbra, PORTUGAL

Personal Information

Cláudia Paulino (claudia_paulino@hotmail.com)

Bruno Graça

Miguel Seco

Frederico Cavalheiro

Luísa Teixeira

Manuela Gonçalo

Filipe Caseiro-Alves

References

Lipoid pneumonia: spectrum of clinical and radiologic manifestations.

Betancourt SL, Martinez-Jimenez S, Rossi SE, Truong MT, Carrillo J, Erasmus JJ.
AJR Am J Roentgenol. 2010 Jan;194(1):103-9.

Wegener's granulomatosis in the chest: high-resolution CT findings.

Ananthakrishnan L, Sharma N, Kanne JP.
AJR Am J Roentgenol. 2009 Mar;192(3):676-82.

Multidetector CT of blunt thoracic trauma.

Kaewlai R, Avery LL, Asrani AV, Novelline RA.
Radiographics. 2008 Oct;28(6):1555-70.

Mucoid impactions: finger-in-glove sign and other CT and radiographic features.

Martinez S, Heyneman LE, McAdams HP, Rossi SE, Restrepo CS, Eraso A.
Radiographics. 2008 Sep-Oct;28(5):1369-82.

Congenital anomalies of the tracheobronchial tree, lung, and mediastinum: embryology, radiology, and pathology.

Berrocal T, Madrid C, Novo S, Gutiérrez J, Arjonilla A, Gómez-León N.
Radiographics. 2004 Jan-Feb;24(1):e17.

Radiologic manifestations of sarcoidosis in various organs.

Koyama T, Ueda H, Togashi K, Umeoka S, Kataoka M, Nagai S.

Radiographics. 2004 Jan-Feb;24(1):87-104.

Bronchopulmonary foregut malformations: embryology, radiology and quandary.

Barnes NA, Pilling DW.

Eur Radiol. 2003 Dec;13(12):2659-73.

Thrombotic and nonthrombotic pulmonary arterial embolism: spectrum of imaging findings.

Han D, Lee KS, Franquet T, Müller NL, Kim TS, Kim H, Kwon OJ, Byun HS.

Radiographics. 2003 Nov-Dec;23(6):1521-39.

Imaging of pulmonary tuberculosis.

Van Dyck P, Vanhoenacker FM, Van den Brande P, De Schepper AM.

Eur Radiol. 2003 Aug;13(8):1771-85.

Interstitial lung diseases associated with collagen vascular diseases: radiologic and histopathologic findings.

Kim EA, Lee KS, Johkoh T, Kim TS, Suh GY, Kwon OJ, Han J.

Radiographics. 2002 Oct;22 Spec No:S151-65.

Developmental lung anomalies in the adult: radiologic-pathologic correlation.

Zylak CJ, Eyler WR, Spizarny DL, Stone CH.

Radiographics. 2002 Oct;22 Spec No:S25-43.

Organizing pneumonia: the many morphological faces.

Oikonomou A, Hansell DM.

Eur Radiol. 2002 Jun;12(6):1486-96.

Traumatic injuries: imaging of thoracic injuries.

Gavelli G, Canini R, Bertaccini P, Battista G, Bnà C, Fattori R.

Eur Radiol. 2002 Jun;12(6):1273-94.

Thoracic sequelae and complications of tuberculosis.

Kim HY, Song KS, Goo JM, Lee JS, Lee KS, Lim TH.

Radiographics. 2001 Jul-Aug;21(4):839-58.

From the archives of the AFIP: pulmonary vasculature: hypertension and infarction.

Frazier AA, Galvin JR, Franks TJ, Rosado-De-Christenson ML.

Radiographics. 2000 Mar-Apr;20(2):491-524.

Radiologic manifestations of round pneumonia in adults.

Wagner AL, Szabunio M, Hazlett KS, Wagner SG.

AJR Am J Roentgenol. 1998 Mar;170(3):723-6.

Intralobar sequestration: radiologic-pathologic correlation.

Frazier AA, Rosado de Christenson ML, Stocker JT, Templeton PA.

Radiographics. 1997 May-Jun;17(3):725-45.

From the archives of the AFIP. Extralobar sequestration: radiologic-pathologic correlation.

Rosado-de-Christenson ML, Frazier AA, Stocker JT, Templeton PA.

Radiographics. 1993 Mar;13(2):425-41.

CT of focal pulmonary masses in childhood.

Shady K, Siegel MJ, Glazer HS.

Radiographics. 1992 May;12(3):505-14.

