CT Case Review Workshop - Chest

January 25, 2013 12:45-5:00 p.m.

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I have no disclosures and no conflicts of interest
• **Educational Objectives**

  Upon completion of this activity, the participant will be able to:

  1. Review important incidental findings seen on CT examinations performed in conjunction with PET/CT and SPECT/CT.

  2. Explain the value of CT images in increasing the accuracy of PET/CT interpretations.

  3. Learn the CT anatomy of the chest.
CT Case Review Workshop - Chest

• Cases 26-37: 12:45 – 2:45 p.m.

• Break: 2:45 – 3:00 p.m.

• Cases 38-50: 3:00 - 5:00 p.m.
CT Case Review Workshop - Chest

- Total of 25 chest CT cases
- 16 SAM (Self-Assessment Module) questions
CT Case Review - Chest
Approach to analysis and reporting

• Consider checklist and structured report
• Look at different window/levels
  – Lung
  – Soft tissue
  – Bone
• MIPS to detect small pulmonary nodules and to distinguish from vessels
• Sagittal and coronal reconstructions for detection and especially problem-solving
Consider checklist and structured report
Cases 26-37

12:45 – 2:45 p.m.
Case 26
(Appropriate use of Fleischner guidelines for small solid pulmonary nodules)

30 year old for follow-up of rectal cancer
Lung nodules are detected very commonly on computed tomographic (CT) scans of the chest, and the ability to detect very small nodules improves with each new generation of CT scanner. In reported studies, up to 51% of smokers aged 50 years or older have pulmonary nodules on CT scans. However, the existing guidelines for follow-up and management of noncalcified nodules detected on nonscreening CT scans were developed before widespread use of multi-detector row CT and still indicate that every Indeterminate nodule should be followed with serial CT for a minimum of 2 years. This policy, which requires large numbers of studies to be performed at considerable expense and with substantial radiation exposure for the affected population, has not proved to be beneficial or cost-effective. During the past 5 years, new information regarding prevalence, biologic characteristics, and growth rates of small lung cancers has become available; thus, the authors believe that the time-honored requirement to follow every small Indeterminate nodule with serial CT should be revised. In this statement, which has been approved by the Fleischner Society, the pertinent data are reviewed, the authors’ conclusions are summarized, and new guidelines are proposed for follow-up and management of small pulmonary nodules detected on CT scans.
### Recommendations for Follow-up and Management of Nodules Smaller than 8 mm Detected Incidentally at Nonscreening CT

<table>
<thead>
<tr>
<th>Nodule Size (mm)*</th>
<th>Low-Risk Patient†</th>
<th>High-Risk Patient‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤4</td>
<td>No follow-up needed§</td>
<td>Follow-up CT at 12 mo; if unchanged, no further follow-up‖</td>
</tr>
<tr>
<td>&gt;4–6</td>
<td>Follow-up CT at 12 mo; if unchanged, no further follow-up‖</td>
<td>Initial follow-up CT at 6–12 mo then at 18–24 mo if no change‖</td>
</tr>
<tr>
<td>&gt;6–8</td>
<td>Initial follow-up CT at 6–12 mo then at 18–24 mo if no change</td>
<td>Initial follow-up CT at 3–6 mo then at 9–12 and 24 mo if no change</td>
</tr>
<tr>
<td>&gt;8</td>
<td>Follow-up CT at around 3, 9, and 24 mo, dynamic contrast-enhanced CT, PET, and/or biopsy</td>
<td>Same as for low-risk patient</td>
</tr>
</tbody>
</table>

Note.—Newly detected indeterminate nodule in persons 35 years of age or older.

* Average of length and width.
† Minimal or absent history of smoking and of other known risk factors.
‡ History of smoking or of other known risk factors.
§ The risk of malignancy in this category (<1%) is substantially less than that in a baseline CT scan of an asymptomatic smoker.
‖ Nonsolid (ground-glass) or partly solid nodules may require longer follow-up to exclude indolent adenocarcinoma.
Fleischner Society Guidelines for Small Pulmonary Nodules

- FOR incidental small solid nodules
- NOT for patients with known or suspected malignancy
- NOT for patients less than 35 years of age
- NOT for patients with unexplained fever in whom infection is suspected
- NOT for subsolid nodules
SAM question 1

Appropriate use of Fleischner society guidelines for small solid pulmonary nodules
SAM question 1

Which of the following is an appropriate application of the Fleischner guidelines for the management of small pulmonary nodules detected on chest CT?

a. New small pulmonary nodule in a patient with melanoma

b. Small pulmonary nodule in a 25 year old patient being evaluated for pulmonary embolism

c. Small pulmonary nodules in a patient with unexplained fever suspected of having infection

d. Small solid indeterminate pulmonary nodule seen as an incidental finding in a 55 year old smoker without known malignancy
SAM question 1

Answer & comment

a. is incorrect because the Fleischner guidelines are NOT applicable to patients with known malignancy

b. is incorrect because the Fleischner guidelines are applicable only to patients 35 years of age or older

c. is incorrect because the Fleischner guidelines are NOT applicable in patients with suspected infection

d. is correct because the Fleischner guidelines are indicated for small solid indeterminate nodules detected incidentally in patients 35 years of age or older without known malignancy or suspicion of infection.
Reference for question 1

Case 27
(Reactivation pattern tuberculosis)
57 year old female with MDR TB
Reactivation pattern tuberculosis

- Don’t forget TB in your differential! Also remember to notify clinicians urgently, if suspected – patient may need to be in respiratory isolation.

- Favors apical and apical posterior segments of upper lobes and to a lesser degree superior segments of lower lobes

- Pancoast (superior sulcus) lung cancers also occur at the lung apex
SAM question 2

Reactivation (post-primary) pattern of TB
SAM question 2

Consolidation and cavitation in which of the following pulmonary locations is most suspicious for post primary pattern tuberculosis in the appropriate clinical setting?

a. Apical and/or posterior segments of upper lobes

b. Basal segments of lower lobes

c. Right middle lobe

d. Anterior segment of lobes
SAM question 2
Answer & comment

• a. is correct; superior segments of lower lobes can also be involved with post-primary pattern TB

• b. is incorrect because basal segments are usually not involved

• c. is incorrect because right middle lobe is usually not involved; but right middle lobe and lingual can be characteristically involved in atypical mycobacterial infections (e.g. MAI)

• d. is incorrect because the anterior segment of upper lobes is usually not involved in post primary TB, but this can be a favored location for primary lung cancer
Reference for question 2

Case 28
(Metastasis to the heart and crista terminalis)
65 year old woman with melanoma
Figure 3. Axial contrast-enhanced CT scan shows a filling defect (arrow) projecting from the lateral wall into the right atrium (RA). The filling defect is seen in the characteristic location of the **crista terminalis**. \( A = \) aorta, \( LA = \) left atrium, \( RV = \) right ventricle.

Broderick L S et al. Radiographics 2005;25:441-453
SAM question 3

Filling defect in right atrium of heart
What is the most likely cause of the filling defect the arrow is pointing to in this figure?

a. Crista terminalis
b. Thrombus in the right atrium
c. Metastasis
d. Primary cardiac tumor
a. is correct, this is crista terminalis (fig. 3 from reference) a normal structure/ridge in the right atrium dividing the rough (pectinate muscles) from the smooth portion of this atrium (please also see diagram fig. 1 from reference - arrowheads)

b. is incorrect, thrombus is possible in the right atrium, but this is the typical location and appearance of crista terminalis

c. is incorrect, metastasis to the heart can be seen as in case 28, but this appearance is more typical of crista terminalis

d. is incorrect, primary tumors can occur in the heart such as myxoma (benign and more common in the left atrium) and angiosarcoma (most common malignant tumor of the heart and more frequent in the right atrium, but less common than myxoma), but this appearance is more typical of crista terminalis
Reference for question 3

Case 29
Hypertrophic cardiomyopathy

54 year old man with kidney cancer for follow up
Hypertrophic cardiomyopathy

• Is a common cause of sudden cardiac death (from arrhythmia)
• Most are asymptomatic
• LV wall thickness > 1.5 cm
• Most common is asymmetric basal septal hypertrophy
• Can have dynamic LV outlet obstruction
• May have systolic anterior motion (SAM) of mitral valve leaflet
Case 30
Large pericardial fat pad
42 year old man after trauma
Cardiophrenic angle mass

• Lipomatosis in pericardial fat pad
  – Pericardial fat pad necrosis

• Morgagni hernia/diaphragmatic hernia

• Adenopathy

• Pericardial cyst
Case 31
High pericardial recess

51 year old female with COPD
Pictorial Essay

Anatomy of Pericardial Recesses on Multidetector CT: Implications for Oncologic Imaging


The pericardium, consisting of a fibrous sac that encloses the heart, is routinely imaged on CT [1-4]. Multidetector technology, in allowing rapid acquisition of volumetric data in high resolution and multichannel reconstruction, has improved nematic imaging. Imaging with narrow collimation results in improved delineation of cardiovascular anatomy and reveals visualization of the pericardial recesses. The pericardial space normally contains a small amount of fluid (15-20 ml), and the fluid-filled recesses and spaces can be misinterpreted as adhesions or abnormalities of an adjacent mediastinal structure. In oncologic imaging, staging and prognostic implications of fluid in a pericardial recess misinterpreted as adhesions can significantly alter management and therapy. We review the anatomy of the pericardium with emphasis on the pericardial recesses that can potentially be misinterpreted as adhesions.

Materials and Methods

Multidetector CT (MDCT) of the chest was performed in 45 patients on a Lightspeed QX/i scanner (General Electric Medical Systems, Milwaukee, WI) with 0.75-mm collimation at 120-135 kVp and 350-370 mA. Nonfatal contrast materials (120-150 ml) were injected as a rate of 5-7 ml/sec. Multidetector reconstructions were performed on a Volume 1 workstation (Vital Images, Minneapolis, MN).

Anatomy

The pericardium consists of an outer fibrous compartment and an inner double-layered serosal sac that surrounds the heart. The visceral layer or epicardium, surrounds the heart and great vessels, and the parietal layer lines the fibrous compartment. The reflections of the serosal layers are arranged around two complex tubes. One tube encloses the aorta and pulmonary trunk. The second tube encloses the superior vena cava, the inferior vena cava, and the four
Figure 2
The asterix (*) in the figure from a contrast enhanced CT of the chest is on a:

a. lymph node
b. pericardial recess
c. thrombosed pseudoaneurysm of the ascending aorta
d. small thymoma
SAM question 4
Answer & comment

a. is incorrect; the shape, density (fluid), and characteristic location favor a common pericardial recess that should not to be confused with a lymph node

b. is correct because its shape, density and characteristic location (behind ascending aorta) favor this commonly seen pericardial recess (this is figure 2 in reference)

c. is incorrect because this would be an unusual location for an aortic pseudoaneurysm; more common would be inferior to distal aortic arch near attachment of ligamentum arteriosum associated with high-speed deceleration trauma

d. is incorrect because the thymoma is usually an anterior mediastinal mass; the asterix is located in the middle mediastinum
Reference for question 4

Case 32
Pulmonary hamartoma

71 year old woman with COPD
Pulmonary hamartoma

• Benign but can grow slowly

• Fat visible in about 60% (on CT)

• Most often in men older than 50

• Conglomerate ("popcorn") calcification in about 25%
SAM question 5

Which of the following is NOT true of pulmonary hamartoma?

a. Pulmonary hamartoma is benign, but can grow slowly

b. Fat is visible within it on CT in about 60% of cases

c. Most commonly seen in young women

d. Pulmonary hamartomas can have calcification (about 25%)
SAM question 5
Answer & comment

a. is true because pulmonary hamartomas are benign but can slowly grow

b. is true because fat is often visible within pulmonary hamartomas on CT

c. is NOT true because pulmonary hamartomas are most often seen in men older than 50 years of age

d. is true because pulmonary hamartomas can have conglomerate ("popcorn") calcification
References for question 5


Case 33
Loculated pleural fluid in fissure

54 year old woman with end-stage renal disease
Loculated pleural fluid in fissure

- American football shape along a fissure
- Fluid density
Case 34
Right-sided aortic arch with aberrant origin of left subclavian artery

70 year old woman with metastatic leiomyosarcoma
Right-sided aortic arch

• Right arch with mirror branching
  – High association with congenital heart disease

• Right arch with aberrant origin of left subclavian artery (may be dilated at origin
  – diverticulum of Kommerell)
  – Usually incidental and most often asymptomatic
Case 35
Azygous continuation of inferior vena cava (IVC)

41 year old woman with patent foramen ovale and ankle fracture
Azygous continuation of IVC

- Developmental
- IVC interrupted above renal veins
  - Lack of development of suprarenal part of subcardinal vein
- Hepatic veins drain directly into right atrium
Case 36
Fungal pneumonia

63 year old woman with myelodysplastic syndrome and post matched unrelated donor stem cell transplant
Coronal graphic shows multiple foci of invasive aspergillosis with central necrotic lung balls, surrounding air crescents & halos of peripheral hemorrhage.

Coronal CECT shows central consolidation from invasive aspergillosis (curved arrows) & a surrounding halo of ground-glass opacity (arrows), consistent with hemorrhage from angioinvasion.
Invasive aspergillus

- Immunocompromised
- Solid nodule surrounded by ground glass opacity
SAM question 6

Which of the following radiological signs can be associated with pulmonary invasive aspergillosis?

a. Atoll sign
b. Halo sign
c. Popcorn calcification
d. Reverse halo sign
SAM question 6
Answer & comment

a. is incorrect because atoll sign is associated with organizing pneumonia

b. is correct because halo sign (ground-glass opacity surrounding a denser central nodule) can be seen with invasive aspergillosis and is a helpful sign in the appropriate clinical scenario such as neutropenic fever

c. is incorrect, this sign is associated with pulmonary hamartoma (please see question 5)

d. is incorrect, this sign can be seen with organizing pneumonia
Reference for question 6

Atoll sign and organizing pneumonia

Webb & Higgins …
Case 37
Thymoma with pleural spread

39 year old woman for followup of malignant thymoma
Circumferential lobulated pleural thickening/masses

• Pleural metastases

• Mesothelioma

• Invasive thymoma

• Lymphoma
SAM question 7

Thymoma is usually found in which mediastinal compartment?

a. Middle  
b. Posterior  
c. Anterior  
d. Inferior
SAM question 7
Answer & comment

a. is incorrect because the thymic gland is in the anterior compartment

b. is incorrect because thymomas are usually in the anterior compartment; neurogenic tumors are more common in the posterior compartment

c. is correct, because thymomas are classically located in the anterior compartment of the mediastinum

d. is incorrect, because there is no inferior compartment of the mediastinum in the usual schemes of classification
Cases 26-37

26. Fleischner guidelines for small incidental solid pulmonary nodules
27. MDR TB
28. Crista terminalis
29. HCM
30. Pericardial fat pad
31. High pericardial recess
32. Pulmonary hamartoma
33. Loculated pleural fluid in fissure
34. R aortic arch with aberrant LSA
35. Azygous continuation of IVC
36. MDS with invasive aspergillus
37. Malignant Thymoma into pleura
CT Case Review Workshop - Chest Break

2:45 – 3:00 p.m.
Cases 38-50

3:00 - 5:00 p.m.
Case 38
Penetrating aortic ulcer

93 year old man with metastatic prostate cancer
Penetrating aortic ulcer

- Can present similar to aortic dissection one of differentials for acute aortic syndrome:
  - Aortic dissection
  - Penetrating aortic ulcer
  - Intramural hematoma
  - Leaking aortic aneurysm
- Can be complicated by dissection, pseudoaneurysm, or aortic rupture
- One of the most common locations is in mid-descending aorta
- Most often happens in the elderly
Which of the following is NOT true of penetrating aortic ulcer of the aorta?

a. Can present similar to aortic dissection with sudden onset of chest and/or back pain

b. Can be complicated by dissection, pseudoaneurysm, or aortic rupture

c. One of the most common locations is in the mid-descending thoracic aorta

d. Usually happens in younger patients
SAM question 8
Answer & comment

a. is true because aortic ulcer is a differential diagnosis for acute aortic syndrome which also includes aortic dissection and intramural hematoma

b. is true and these serious complications can often be prevented by medical management (control of blood pressure), surgical repair, or endovascular stenting as appropriate

c. is true, this is one of the most common locations

d. is NOT true, penetrating aortic ulcer of the aorta most often happens in the elderly
Reference for question 8

Case 39
Aortic intramural hematoma
79 year old man
Aortic intramural hematoma

Axial NECT shows crescentic high density material (black open) within the wall of an ascending aortic aneurysm (white arrow). The high density within the wall reflects hemorrhage from rupture of the vasa vasorum into the aortic media.

Axial T1WI GRE shows a crescentic area of high signal (black arrow) along the aortic wall consistent with an aortic intramural hematoma. Note the elliptical shape of the aortic lumen.
Aortic intramural hematoma

• One of differentials for acute aortic syndrome:
  – Aortic dissection
  – Penetrating aortic ulcer
  – Intramural hematoma
  – Leaking aortic aneurysm

• Rupture of vasa vasorum resulting in hematoma in aortic media

• Typically hypertensive

• Treated similar to aortic dissection
Case 40
Tracheal tumor
60 year old man
Malignant tracheal tumors

- Most common malignant tracheal tumors are:
  - Squamous cell carcinoma
  - Adenoid cystic carcinoma
SAM question 9

Which of the following are the most common primary malignant tumors of the trachea?

a. Squamous cell papilloma and hamartoma

b. Sarcoma and lymphoma

c. Squamous cell carcinoma and adenoid cystic carcinoma

d. Carcinoid and mesenchymal tumors
SAM question 9
Answer & comment

a. is incorrect, these are **benign** tumors of the trachea

b. is incorrect, these malignant tumors of the trachea are rare

c. is correct, these are the most common primary malignant tumors of the trachea

d. is incorrect, carcinoid of the trachea is rare and mesenchymal tumors of the trachea can be benign
Reference for question 9

Case 41
Bronchial atresia/sequestration/congenital pulmonary airway malformation (CPAM) hybrid

66 year old female with COPD
Bronchial atresia/sequestration/congenital pulmonary airway malformation (CPAM) hybrid

• Maldevelopment

• Sequestration
  – Systemic arterial supply
  – Intralobar & extralobar types

• “CPAM” now recommended over “CCAM”
Case 42

Thymic rebound

23 year old man with melanoma after treatment
Case 43
Fluid in pericardial sleeve around pulmonary vein
67 year old female with non small cell lung cancer
Anatomy of Pericardial Recesses on Multidetector CT: Implications for Oncologic Imaging
Truong, et al, AJR 2003; 181:1109-113
Case 44
Wegener granulomatosis

21 year old woman with chest pain
Wegener granulomatosis

- Multi-systemic vasculitis
  - Lung, kidney, and paranasal
- Ground glass and consolidation opacities from hemorrhage
- Pulmonary nodules and cavities
- Tracheobronchial involvement thickening/narrowing especially in subglottic trachea
SAM question 10

Which of the following are the least common findings in Wegener’s granulomatosis?

a. Lung, kidney, and paranasal sinus involvement

b. Hilar and mediastinal lymph node involvement

c. Lung consolidation due to hemorrhage

d. Pulmonary nodules and cavities and tracheobronchial thickening with narrowing especially in the subglottic trachea
SAM question 10
Answer & comments

a. is incorrect, lung, kidney, and paranasal sinus involvement are common in Wegener’s

b. is correct, hilar and mediastinal lymph node enlargement can happen but is unusual in Wegener’s

c. is incorrect, Wegener’s involves a vasculitis and can often give pulmonary hemorrhage

d. is incorrect, pulmonary nodules and cavities, and tracheobronchial involvement especially in the subglottic trachea are common in Wegener’s
Reference for question 10

Case 45
Pulmonary embolism with pulmonary infarcts
56 year old man with dyspnea and tachycardia
Pulmonary emboli

- Pulmonary arterial filling defects

- Can be associated with:
  - Peripheral lung opacities and pleural effusions
  - Right heart strain:
    - enlarged right heart,
    - straightening or reverse bowing of interventricular septum)
SAM question 11

Which of the following is NOT associated with pulmonary emboli?

a. Peripheral lung opacities and pleural effusions
b. Pulmonary arterial filling defects
c. Right heart strain
d. Honeycombing at lung bases
a. is true, peripheral lung opacities (pulmonary infarcts) and pleural effusions can be seen with pulmonary emboli

b. is true, pulmonary arterial filling defects are the primary sign of pulmonary emboli

c. is true, pulmonary emboli with a large clot load can strain the right heart (on CT: enlarged right heart, straightening or reverse bowing of interventricular septum)

d. is NOT associated with pulmonary emboli this is an important finding in usual interstitial pneumonia (UIP) – please see question 12
Reference for question 11

Case 46
Usual interstitial pneumonia (UIP)

53 year old man with systemic sclerosis/scleroderma
Usual interstitial pneumonia

- Peripheral basal-predominant honeycombing

- Traction bronchiectasis (parenchymal fibrosis)

- Ground glass NOT a predominant feature in non-complicated UIP
Which of the following features is NOT characteristic of the radiological appearance of usual interstitial pneumonia (UIP)?

a. Upper lung zone predominant pattern

b. Traction bronchiectasis

c. Ground glass opacity is usually NOT a predominant feature

d. Peripheral basal-predominant honeycombing
SAM question 12
Answer & comment

a. is NOT true, UIP is characteristically a **basal predominant** process (please also see question 13)

b. is true, traction bronchiectasis which is secondary to surrounding lung fibrosis is a feature seen in UIP

c. is true, ground glass should NOT be a predominant feature in uncomplicated UIP (sometimes is seen in UIP during an accelerated episode secondary to superimposed diffuse alveolar damage)

d. is true, UIP characteristically demonstrates peripheral basal-predominant honeycombing
References for question 12


Case 47
Sarcoid

57 year old man with metastatic renal cancer
Thoracic sarcoid

- Symmetric hilar and mediastinal lymph node enlargement
- Upper zone predominant perilymphatic (peribronchovascular) pulmonary nodules
Which of the following is the best diagnostic clue for sarcoidosis in the chest?

a. Basal-predominant honeycombing

b. Symmetric hilar and mediastinal lymph node enlargement which may be accompanied by upper zone predominant perilymphatic (peribronchovascular) pulmonary nodules

c. Anterior mediastinal mass

d. Diffuse lung consolidation
SAM question 13
Answer & comment

a. is incorrect, sarcoid is more typically an upper zone predominant process

b. is correct, symmetric hilar and mediastinal lymph node enlargement with or without upper zone predominant pulmonary nodules in perilymphatic distribution are typical for sarcoid (may need biopsy confirmation)

c. is incorrect, anterior mediastinal mass would be more typical of thymoma (please see question 7), or germ-cell tumor or lymphoma or substernal thyroid.

d. is incorrect, diffuse consolidation would be more typical of infection or edema or hemorrhage or mucinous adenocarcinoma (please see discussion case 50) or other more unusual causes
Case 48
Diffuse alveolar hemorrhage

26 year old man with acute promyelocytic leukemia (APML) on treatment with all trans retinoic acid (ATRA)
Airspace opacity
Consolidation & ground glass opacity

- Water
- Pus
- Blood
- Cells
- Other
Case 49
Solitary pulmonary nodule with known extrathoracic malignancy

74 year old female with breast cancer
Solitary pulmonary nodule with known extrathoracic malignancy

- More likely to have primary lung cancer than metastases:
  - Head & neck 8:1
  - Bladder
  - Breast
  - Cervix
  - Bile ducts
  - Esophagus
  - Ovary
  - Prostate
  - Stomach
Solitary pulmonary nodule with known extrathoracic malignancy

• More likely to be a solitary metastasis (2.5:1):
  – Melanoma
  – Sarcoma
  – Testicular cancer
Solitary pulmonary nodule with known extrathoracic malignancy

• Fairly even odds (1:1) primary lung vs solitary metastasis:
  – Salivary glands (including parotid)
  – Adrenal
  – Colon
  – Kidney
  – Thyroid
  – Thymus
  – Uterus
SAM question 14

With which of the following extrathoracic tumors is a solitary pulmonary nodule (SPN) detected in the lung more likely to be a primary lung cancer rather than a metastasis?

a. Head & neck carcinoma

b. Melanoma

c. Sarcoma

d. Testicular cancer
SAM question 14
Answer & comments

a. is correct, a SPN in a patient with head and neck cancer should be evaluated for possible primary lung cancer rather than just assuming it is a metastasis.

b. is incorrect, a SPN in a patient with melanoma is more likely to have a solitary lung metastasis rather than a lung cancer

c. is incorrect, a SPN in a patient with sarcoma is more likely to have a solitary lung metastasis rather than a lung cancer

d. is incorrect, a SPN in a patient with testicular is more likely to have a solitary lung metastasis rather than a lung cancer
Reference for SAM question 14

Case 50
Mixed density (subsolid) focal lung lesion
Mixed density (subsolid) focal lung lesion

• According to the Early Lung Cancer Action Project (ELCAP)
  – 63% of part-solid / part-ground glass nodules were malignant
  – 18% of pure ground glass were malignant
  – Only 7% of solid nodules were malignant
Formerly known as bronchioloalveolar carcinoma (BAC)

- Adenocarcinoma in situ (AIS)
- Minimally invasive adenocarcinoma (MIA)
- Lepidic predominant nonmucinous adenocarcinoma
- Invasive mucinous adenocarcinoma
Formerly known as bronchioloalveolar carcinoma (BAC)

• Premalignant lesion (small ground glass nodule):
  – Atypical adenomatosus hyperplasia (AAH)
According to findings from the Early Lung Cancer Action Project (ELCAP) which of the following types of pulmonary nodules on CT were more likely to be malignant?

a. Calcified nodules
b. Pure ground glass
c. Part solid
d. Solid
SAM question 15
Answer & comments

a. is incorrect, many calcified nodules can be old granulomas

b. is incorrect, 18% of pure ground glass nodules were found to be malignant (some of these malignancies may NOT be FDG avid)

c. is correct, 63% of part solid (part ground glass) nodules were found to be malignant (some of these were formerly classified as bronchioloalveolar carcinoma (term no longer to be used) but please see reference 2 below and discussion during session regarding new (2011) classification for adenocarcinoma of the lung)

d. is incorrect, only 7% of solid nodules were malignant
Reference for question 15


New Fleischner guidelines for management of subsolid pulmonary nodules

<table>
<thead>
<tr>
<th>Nodule Type</th>
<th>Management Recommendations</th>
<th>Additional Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solitary pure GGNs</td>
<td>No CT follow-up required</td>
<td>Obtain contiguous 1-mm-thick sections to confirm that nodule is truly a pure GGN</td>
</tr>
<tr>
<td>≤5 mm</td>
<td>Initial follow-up CT at 3 months to confirm persistence then annual surveillance CT for a minimum of 3 years</td>
<td>FDG PET is of limited value, potentially misleading, and therefore not recommended</td>
</tr>
<tr>
<td>&gt;5 mm</td>
<td>Initial follow-up CT at 3 months to confirm persistence. If persistent and solid component ≤5 mm, then biopsy or surgical resection</td>
<td>Consider PET/CT for part-solid nodules &gt;10 mm</td>
</tr>
<tr>
<td>Solitary part-solid nodules</td>
<td>Initial follow-up CT at 3 months to confirm persistence. If persistent and solid component ≤5 mm, then biopsy or surgical resection</td>
<td></td>
</tr>
<tr>
<td>Multiple subsolid nodules</td>
<td>Pure GGNs ≤5 mm</td>
<td>Consider alternate causes for multiple GGNs ≤5 mm</td>
</tr>
<tr>
<td></td>
<td>Obtain follow-up CT at 2 and 4 years</td>
<td></td>
</tr>
<tr>
<td>Pure GGNs &gt;5 mm without a dominant lesion(s)</td>
<td>Initial follow-up CT at 3 months to confirm persistence and then annual surveillance CT for a minimum of 3 years</td>
<td>FDG PET is of limited value, potentially misleading, and therefore not recommended</td>
</tr>
<tr>
<td>Dominant nodule(s) with part-solid or solid component</td>
<td>Initial follow-up CT at 3 months to confirm persistence. If persistent, biopsy or surgical resection is recommended, especially for lesions with &gt;5 mm solid component</td>
<td>Consider lung-sparing surgery for patients with dominant lesion(s) suspicious for lung cancer</td>
</tr>
</tbody>
</table>
According to the new (2013) Fleischner Society recommendations for the management of subsolid pulmonary nodules detected on CT what should be done with a solitary pure ground glass nodule (GGN) greater than 5 mm?

a. No CT follow-up required

b. PET and biopsy

c. Surgical resection

d. Initial follow-up at 3 months then annual surveillance for a minimum of 3 years.
SAM question 16
Answer & comments

a. is incorrect, only if the GGN is 5 mm or less is no CT follow-up required

b. is incorrect, PET may not be FDG avid and biopsy is not a recommendation for this description

c. is incorrect, surgical resection or biopsy is recommended for persistent (still present at 3 months) part-solid nodules with > 5 mm solid component

d. is correct, please see table p. 306 of reference below
Cases 38-50

38. Penetrating aortic ulcer
39. Aortic intramural hematoma
40. Tracheal tumor
41. Bronchial atresia/sequestration/CPAM hybrid
42. Thymic rebound
43. Fluid in pulmonary vein sheath
44. Wegener granulomatosis
45. Pulmonary emboli with pulmonary infarcts
46. UIP in scleroderma
47. Sarcoid + renal CA
48. DAH/ APML/ATRA
49. SPN in breast CA
50. Subsolid pulmonary nodules and new classification and new Fleischner guidelines
We’re Done!
Thank you!
Hope this was helpful to your practice and understanding and that you enjoy and learn a lot at the rest of the meeting!

Hope your trip home is safe and smooth!