1. You are shown a CT image of a 63-year-old man who underwent heart transplantation for ischemic cardiomyopathy two years ago. What is the MOST LIKELY diagnosis?

A. Bronchiolitis obliterans
B. Post-transplant lymphoproliferative disease
C. Cryptogenic organizing pneumonia
D. Bronchogenic carcinoma

Rationales:
A. Incorrect. More commonly seen after lung transplantation, bronchiolitis obliterans usually is radiographically occult. When it is seen, it may be seen as areas of air-trapping or mosaic attenuation. Other reported findings include bronchiectasis and septal line thickening. Solitary nodule is not a finding of bronchiolitis obliterans.
B. Incorrect. Post-transplant lymphoproliferative disease (PTLD) (after infection) is one of the most common explanations for a solitary pulmonary nodule in the post-transplanted patient. The imaging features include one or more smooth nodules or areas of consolidation with air bronchograms. A single, spiculated nodule would be an unusual manifestation of PTLD.
C. Incorrect. Cryptogenic organizing pneumonia (COP) is another finding that may be encountered in the post-transplant patient. COP may present with peripheral consolidations (similar to chronic eosinophilic pneumonia) or may present in a nodular form. The nodular form tends to have air bronchograms. A solitary nodule with spiculation would be highly unlikely for COP. In fact, a biopsy of this nodule would likely be repeated if COP was the pathologic diagnosis, in order to exclude inadequate sampling as biopsy of the area adjacent to a neoplasm will result in a pathologic diagnosis of COP.
D. Correct. As transplant patients are living longer, it has become well-accepted that transplant immunosuppression results in an increased risk of solid-organ tumors, especially in smokers. In this patient, smoking had contributed to his ischemic cardiomyopathy. Radiologic features of
these neoplasms are similar to the features in a non-transplant patient. If this CT were reviewed without the transplant history, bronchogenic neoplasm would lead the differential diagnosis. This lesion was biopsied and this suspicion was confirmed.

2. You are shown a CT image and two images from an F-18 FDG (fluorodeoxyglucose) PET scan of a 71-year-old man. What is the MOST LIKELY diagnosis?
A. Benign nodule
B. Stage I lung cancer
C. Stage II lung cancer
D. Stage IV lung cancer

Findings:
A small irregularly marginated uncalcified nodule on CT shows intense activity on FDG PET scan. In addition, there is a large focus of intense activity in the region of the right adrenal gland.

Rationales:
A. Incorrect. Benign nodules may show uptake on FDG PET scan, but rarely this intense. Benign etiology does not explain adrenal activity.
B. Incorrect. Without the adrenal activity, this would be typical of Stage I lung cancer.
C. Incorrect. There is no adjacent nodal activity to suggest T1or2N1 disease.
D. Correct. The adrenal gland is one of the most common sites of metastasis from bronchogenic carcinoma and may be seen in otherwise Stage I disease. This tumor is T1N0M1 or Stage IV.

3. For which of the following is obtaining a definitive diagnosis with needle biopsy MOST DIFFICULT?

A. Hamartoma
B. Healed granuloma
C. Lymphoma
D. Metastatic carcinoma

Rationales:
A, C and D are Incorrect.
B is Correct. Percutaneous needle biopsy is most commonly used to biopsy intrathoracic or parenchymal lesions. Either 22Gauge needles or 20 Gauge core biopsy needles are utilized. Percutaneous needle biopsy is most commonly used to establish a diagnosis of malignancy. The sensitivity for diagnosis of malignancy (primary and metastatic) is about 85 – 95%. Diagnosis of Lymphoma and Hamartoma is a little more difficult and sensitivity is in the range of 50 – 65%. However, histologic diagnosis of benign lesions such as granuloma is far more difficult. In general, granulomas that are active can be diagnosed by needle biopsy by demonstrating a positive culture. However, healed granulomas contain necrotic material and far fewer inflammatory cells. Thus, scant cellularity and minimal number of organisms in a healed granuloma result in far fewer definitive diagnoses than Lymphoma, Hamartoma and Metastasis.
4. Which one of the following injuries is indicated by the dependent viscera sign?

A. Bronchial fracture
B. Diaphragmatic rupture
C. Pulmonary laceration
D. Traumatic aortic tear

Rationales:
A. Incorrect
B. Correct. Tear in the diaphragm results in herniation of viscera (bowel and solid organs) into the thoracic cavity. As the injured diaphragm no longer supports these structures posteriorly, they fall to a dependent position against the posterior ribs. Hence, the dependent viscera sign is observed in patients with diaphragmatic injury when they lie supine for a CT scan.
C. Incorrect
D. Incorrect

5. Eggshell calcification in hilar or mediastinal nodes occurs in which of the following diseases?

A. Tuberculosis
B. Metastatic mucinous adenocarcinoma
C. Histoplasmosis
D. Sarcoidosis

RATIONALES:
A. Incorrect. Calcification in lymph nodes in granulomatous infections tends to be diffuse with complete calcification of the node.
B. Incorrect. Calcification in mucinous adenocarcinoma is usually psammonatous, i.e. punctate or flake like and distributed throughout the node.
C. Incorrect. Calcification in lymph nodes in granulomatous infections tends to be diffuse with complete calcification of the node.
D. Correct. Calcification in lymph nodes in sarcoidosis is a late manifestation and occurs in less than 5% of patients. The pattern is frequently of the eggshell (peripheral) type but this is less commonly seen than in patients with sarcoidosis.

References:
6. Which of the following statements about localized fibrous tumors of the pleura is TRUE?

A. They are associated with asbestos exposure.
B. They are associated with hypertrophic pulmonary osteoarthropathy.
C. They account for the majority of pleural tumors.
D. Most of these tumors arise from parietal pleura.

A. Incorrect.
B. Correct. Localized fibrous tumor of the pleura are relatively rare tumors of the pleura. About 80% of them arise from the visceral pleura. They affect male and female patients equally. They are not associated with smoking, asbestos exposure or other environmental pollutants. About half of the patients are asymptomatic when the tumor is discovered incidentally. They occasionally reach very large size and produce symptoms of cough, dyspnea and chest pain. Paraneoplastic syndromes such as hypoglycemia and hypertrophic osteoarthropathy are present in 4-5% of the cases.
C. Incorrect.
D. Incorrect.

References:
Muller, N.L., Fraser, R.S., Colman, N.C., and Pare', P.D. Radiologic Diagnosis of Diseases of the Chest. W.B. Saunders, Co., Philadelphia, PA 2001

7. Which of the following is TRUE regarding radiation pneumonitis?

A. It usually occurs 6 months after completion of radiation therapy.
B. Chemotherapeutic agents potentiate the effects of radiation.
C. The acute phase of injury manifests as traction bronchiectasis.
D. Preexisting lung disease has no effect on the development of radiation pneumonitis.

RATIONALIAGES:
A. Incorrect
B. Correct. Radiation pneumonitis is a complication of radiation therapy. Multiple factors determine the development and appearance of pneumonitis. They include, the volume of lung involved, the type of radiation used, the time period over which radiation therapy was given, whether chemotherapy was given at the same time, and whether there was preexisting lung disease to name a few. Radiation pneumonitis is divided into early and late manifestations. The early or acute pneumonitis occurs within 1 to 3 months following treatment and radiographically appears as homogeneous or patchy ground glass opacities. The changes evolve over the next 6 to 12 months and usually become stable within 2 years. They appear radiographically as dense consolidation, traction bronchiectasis and volume loss.
C. Incorrect
D. Incorrect
8. Which one of the following diseases is MOST LIKELY to be a cause of pulmonary artery aneurysm or pseudoaneurysm?

A. Pulmonary infection  
B. Mediastinal fibrosis  
C. Metastasis  
D. Goodpasture’s syndrome

RATIONALES:
A. **Correct.** Pulmonary artery aneurysms are rare. They may occur secondary to infection (Septic emboli, Tuberculosis etc.), catheter-related complications, pulmonary hypertension or vasculitides. The most common cause is probably catheter-related complications. Rasmussen aneurysm is a mycotic aneurysm that occurs in relation to tuberculosis infection.
B. Incorrect
C. Incorrect
D. Incorrect

References:
Muller, N.L., Fraser, R.S., Colman, N.C., and Pare’, P.D. Radiologic Diagnosis of Diseases of the Chest. W.B. Saunders, Co., Philadelphia, PA 2001

9. Concerning pulmonary mycobacterium avium-intracellulare complex infection, which one of the following is TRUE?

A. Cavitary lesions occur in patients with chronic obstructive pulmonary disease.  
B. Centrilobular nodules occur in immunocompromised patients.  
C. Mediastinal adenopathy occurs in elderly woman without underlying lung disease.  
D. RML and lingular bronchiectasis occurs in patients with hypersensitivity pneumonitis.

RATIONALES:
A. **Correct.** Mycobacterium avium-intracellulare complex infection have four distinct manifestations which occur in different sets of population depending on their underlying clinical status. The classic infection occurs in elderly men with underlying chronic obstructive pulmonary disease or pulmonary fibrosis. Radiographically, nodules and or cavitations are seen in the upper lobes.
B. Incorrect. Mycobacterium avium-intracellulare complex infection in immunocompromised patients appear as mediastinal or hilar adenopathy.
C. Incorrect. Mycobacterium avium-intracellulare complex infection in elderly patients appear as RML and Lingular bronchiectasis with scattered tree-in-bud opacities
D. Incorrect. Hypersensitivity pneumonitis secondary to Mycobacterium avium-intracellulare exposure manifests as centrilobular ground glass opacities.

References:
Muller, N.L., Fraser, R.S., Colman, N.C., and Pare’, P.D. Radiologic Diagnosis of Diseases of the Chest. W.B. Saunders, Co., Philadelphia, PA 2001

10. Which one of the following radiographic signs represents chronic deep vein thrombosis at CT venography?
A. Central low attenuation
B. Perivenous soft tissue edema
C. Venous dilatation
D. Central calcification

RATIONALES:
A. Incorrect.
B. Incorrect
C. Incorrect.
D. Correct. The findings of chronic deep vein thrombosis on CT venography include calcification of thrombi within veins as well as that of venous walls, shrunken veins and presence of collateral vessels. Central low attenuation within veins, perivenous soft tissue edema and venous dilatation are signs of acute deep vein thrombosis.

References:
11. You are shown two CT images of a 50-year-old man 7 days after bone marrow transplant. Which one of the following is the MOST likely diagnosis?

A. Posttransplantation lymphoproliferative disorder  
B. Invasive aspergillosis  
C. Pulmonary edema  
D. Cytomegalovirus infection

Findings:  
Prominent pulmonary vessels, thickening of the interlobular septa, ground-glass opacities, and bilateral pleural effusions.

Rationales:  
A. Incorrect. Posttransplantation proliferative disorder represents lymphocyte proliferation following bone marrow or solid organ transplantation. This may range from benign proliferation to frank malignant transformation. The time between onset of transplantation and onset of disease varies from 1 month to several years. Most common radiographic findings consist of solitary or multiple nodules and hilar or mediastinal adenopathy. The history and radiographic features present in the case lead us away from this diagnosis.  
B. Incorrect. Invasive aspergillosis occurs in the first month following bone marrow transplant when the patient has severe neutropenia. The radiographic features include nodules with or without a halo sign and segmental consolidation. The halo sign represents hemorrhage surrounding the nodule. The history and radiographic features present in the case lead us away from this diagnosis.  
C. Correct. Pulmonary edema is a common complication in the first month following bone marrow transplant. This is secondary to infusion of large volumes of fluid combined with cardiac and renal dysfunction due to prior chemotherapy regimens. The typical features of pulmonary edema are present in this case.
D. Incorrect. Cytomegalovirus infection is caused by reactivation of the latent virus at a time of profound immunosuppression or by infusion of Cytomegalovirus seropositive marrow or blood products. Similar to Pneumocystis carinii pneumonia, Cytomegalovirus infection occurs 1 to 3 months following bone marrow transplant. Radiographic features include multiple nodules, ground-glass attenuation or consolidation. Thus, the clinical history and radiographic features defer from those in the test case.

Citations:
Worthy SA, Flint JD, Muller NL. Pulmonary complications after bone marrow transplant: High-resolution CT and pathologic findings. Radiographics. 1997;17:1359-1371.