What is Your Thoracic Radiology IQ?

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Disclosures

The authors have nothing to disclose.
Learning Objectives

• When presented with puzzling thoracic imaging abnormalities, findings outside of the thorax can provide clues to the correct diagnosis.

• The challenge for the radiologist is to recognize and correlate both the intrathoracic and extrathoracic disease processes to formulate a reasonable interpretation.

• This exhibit consists of a series of cases, presented as unknowns, which will allow participants to test their ability to identify and integrate intrathoracic and extrathoracic findings on imaging studies. Participants should examine the images presented for each case, identify the intrathoracic and extrathoracic abnormalities and attempt to arrive at a single diagnosis that best incorporates all the findings. The correct answer with a brief discussion is provided following each case. At the end of the presentation a score sheet will allow participants to gauge their “Thoracic Radiology IQ.”

• Our aim is that participants find this exercise both informative and entertaining.
Case 1: 32-year-old man with chest pain and hemoptysis. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Findings: T1-weighted coronal image from magnetic resonance (MR) angiography (a) shows large filling defect in right pulmonary artery (arrow) and low signal liver lesions (asterisks). Coronal bright blood image obtained using a steady state free precession sequence (b) shows high signal cystic lesion in right pulmonary artery (arrow) and peripheral high signal cystic lesions (daughter cysts) within the liver lesions. 

Answer: Hydatid liver disease with embolization of hydatid cysts to the pulmonary artery.
Pulmonary Hydatid Disease

- Embolization of echinococcal cysts to the pulmonary arteries is extremely rare, and can be mistaken for pulmonary embolism based on the similar clinical symptoms of cough, acute onset chest pain, and hemoptysis.¹
- Cystic emboli to the pulmonary arteries may originate in the liver, travel through the inferior vena cava and through the right heart chambers into the pulmonary artery.¹
- Hydatid cysts within the pulmonary arteries appear as fluid-attenuation, round intravascular masses that may cause enlargement of the affected vessels.¹
- Although surgical removal of the cysts is the treatment of choice and early treatment is essential, intervention may be complicated by rupture of the artery and/or the cyst which can result in anaphylactic shock, dissemination of disease, further embolism and pseudoaneurysm formation.²
- However, untreated hydatid pulmonary embolism can result in chronic pulmonary hypertension, acute fatal embolism or subacute embolism with pulmonary hypertension and death in less than one year.¹
- The patient may remain asymptomatic as long as the bronchial arteries provide collateral blood supply.¹
Case 2: 37-year-old woman with shortness of breath. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Case 2: 37-year-old woman with shortness of breath. What is your diagnosis?

Findings: Axial computed tomography (CT) images of the chest in soft tissue window (a) and lung window (b) demonstrate calcifications within the anterior portions of the lower lungs (arrows). CT image through the abdomen (c) shows atrophic kidneys due to chronic renal failure (arrows).

Answer: Metastatic pulmonary calcification from chronic renal failure.
Metastatic Pulmonary Calcification

- Metastatic pulmonary calcification (MPC) is a consequence of calcium salts deposition in normal lung parenchyma due to abnormal calcium metabolism.
- Occurs in patients with hypercalcemia, most commonly in patients with hyperparathyroidism secondary to chronic renal failure.
- Can also occur in a variety of disorders including primary and secondary hyperparathyroidism, intravenous calcium therapy, and massive osteolysis from metastases or multiple myeloma.
- Patients are often asymptomatic, however MPC may lead to fulminant respiratory failure and death.
- CT features of MPC are commonly centrilobular ground-glass nodular opacities with numerous poorly defined nodules measuring 3-10 mm.
  - Consolidations can also be seen.
  - Pulmonary calcifications can be punctate within nodular opacities, nodular or may involve entire regions of consolidations.
- Histologic features of MPC are calcium deposits in the alveolar epithelial basement membranes, alveolar capillary walls, bronchial walls, and media of pulmonary arterioles.
Case 3: 54-year-old HIV positive woman with lung lesions. What is your diagnosis?
Case 3: 54-year-old HIV positive woman with lung lesions. What is your diagnosis?

Findings: Axial CT image of the chest (a) shows large masses in the upper lobes. The left upper lobe mass is cavitary (arrow). Axial CT image of the pelvis (b) shows a cervical mass (arrow).

Answer: Cavitary lung metastases from squamous cell cancer of the cervix.
Cavitary Metastases from Cervical Carcinoma

- Squamous cell carcinoma is the most common histologic type of cervical cancer (70%) followed by adenocarcinoma (25%).
- Patients may present with postmenopausal or intermenstrual bleeding, pain, and discharge.
- Cervical cancer first invades the stroma and upper vagina, then the pelvic sidewall and the mucosa of the rectum and bladder.
- The lung is the most common organ involved in distant metastatic disease, with lung metastases occurring in approximately 10% of patients.
- Pulmonary metastases are seen in 21% of patients with recurrent disease.
- Distant metastases are often associated with intra-abdominal metastatic disease.
- The common imaging finding of metastatic cervical cancer is multiple pulmonary nodules, although lung nodules may be solitary.
- Cavitary lung metastases are a unique imaging feature almost always associated with squamous cell histology.
- After the lungs, mediastinal and hilar lymph nodes as well as pleura are the next most commonly affected sites.
- Cervical cancer is the leading cause of cancer death among the 20 million women with HIV worldwide, with the incidence six-fold greater among women with HIV than the general population.
Case 4: 45-year-old woman with mediastinal mass. What is your diagnosis?
Case 4: 45-year-old woman with mediastinal mass. What is your diagnosis?

Findings: Axial image from contrast-enhanced CT of the chest (a) shows soft tissue attenuation mass in the anterior mediastinum representing an enlarged thymus (asterisk). Image at a higher level (b) shows diffuse enlargement of the thyroid gland (asterisk). Coronal reformatted CT image (c) demonstrates thymic and thyroid enlargement.

Answer: Thymic hyperplasia due to Grave’s disease.
Thymic Hyperplasia

- Thymic hyperplasia has two sub-types; true hyperplasia and lymphoid/follicular hyperplasia.
- True thymic hyperplasia implies an enlarged thymus gland with increase in normally-organized thymic tissue.
  - Occurs in patients recovering from recent stressors such as chemotherapy, corticosteroid therapy, radiotherapy, or thermal burns.
  - The gland first becomes atrophic then grows back when the stressor is removed and can become larger than its original size, termed “rebound hyperplasia.”
- Lymphoid hyperplasia indicates an increased number of lymphoid follicles and germinal centers in the thymus.
  - Associated with immunologically-mediated diseases, such as myasthenia gravis and Graves’ disease.⁶,⁷
Thymic Hyperplasia in Graves’ Disease

- Graves’ disease is an autoimmune disorder characterized by diffuse thyroid enlargement as well as signs and symptoms of hyperthyroidism.
- Graves’ is thought to be caused by auto-antibodies directed against a number of thyroid antigens.
- There is an association between increased thymic size and Graves’ disease.
- Thymic size has been found to markedly decrease following treatment with antithyroid drugs.
- The mechanism of thymic hyperplasia in patients with Graves’ disease is suspected to be related to immunological mechanisms.
  - TSH receptors have been identified on various extra-thyroidal tissues including the thymus, and binding of the thyroid-stimulating immunoglobulins may cause thymic hyperplasia in these patients.\(^7,8\)
Case 5: 60-year-old woman with CT performed for abnormal chest radiograph. What is your diagnosis?
Case 5: 60-year-old woman with CT performed for abnormal chest radiograph. What is your diagnosis?

Findings: Axial contrast-enhanced CT image of the chest (a) shows mediastinal lymphadenopathy (arrows). Axial image through the upper abdomen (b) demonstrates surgical clips about the IVC from prior liver transplant (arrows). Axial image of the abdomen (c) shows abdominal lymphadenopathy (arrows).

Answer: Post-transplant lymphoproliferative disease.
Post-Transplant Lymphoproliferative Disease (PTLD)

- PTLD is a group of clinically and pathologically heterogeneous disorders occurring in immunosuppressed patients who have undergone solid organ transplantation or hematopoietic stem cell transplantation.\textsuperscript{9,10}
- Range from indolent polyclonal proliferation to aggressive lymphomas.\textsuperscript{9}
- Mortality ranges from 50-70%.\textsuperscript{9}
- Immunosuppressive therapy required to prevent allograft rejection compromises anti-tumor and anti-viral immunosurveillance.\textsuperscript{9}
- Many cases (55-65%) are attributable to infection or reactivation of Epstein-Barr virus (EBV) and resulting impaired cytotoxic T-cell immunity.\textsuperscript{9,10}
- Most cases of PTLD are B-cell, while 5% of cases are of T-cell or T/NK cell origin.\textsuperscript{10}
- PTLD may appear as lymphadenopathy.
  - Lymph nodes are typically homogenously enhancing and hypoenhancing, and may demonstrate loss of fatty hilum.\textsuperscript{11}
- Extranodal imaging patterns may involve peritoneal nodules, bowel wall thickening, ulceration and polypoid masses, infiltrative or solid organ masses, and multifocal homogenous CNS lesions with rim enhancement.\textsuperscript{11}
Case 6: 32-year-old woman with pulmonary nodules. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Case 6: 32-year-old woman with pulmonary nodules. What is your diagnosis?

Findings: Axial CT image of the chest in lung window (a) shows multiple pulmonary nodules (arrows). Axial CT image of the pelvis (b) shows a diffusely enlarged uterus. Axial image of the pelvis (c) shows numerous ovarian cysts. Transverse ultrasound image of the uterus (d) shows mixed cystic and solid areas in the endometrial cavity (“snowstorm” appearance).

Answer: Metastatic choriocarcinoma.
Lung Metastases from Choriocarcinoma

- Choriocarcinoma is a rare, highly aggressive malignant variant of gestational trophoblastic diseases.\textsuperscript{12,13}
- 50\% of choriocarcinoma cases arise in molar pregnancy, 25\% arise following previous abortions, 22.5\% arise in normal pregnancy, and 2.5\% arise after ectopic pregnancy.\textsuperscript{13}
- Vaginal bleeding is the most common presentation.\textsuperscript{12}
- The lungs are the most common site of metastatic disease, and the rate of lung metastases is 80-85\%.\textsuperscript{12,13}
- The metastases are hypervascular and have a propensity to bleed, resulting in hemoptysis, ARDS, and barotrauma in patients requiring mechanical ventilation.\textsuperscript{12}
- Even if accompanied by metastases, choriocarcinoma is extremely responsive to chemotherapy with a high possibility of cure.\textsuperscript{12,13}
- Metastases with surrounding ground-glass opacities (the “halo” sign) are commonly seen on CT, reflecting alveolar hemorrhage surrounding these vascular lesions.\textsuperscript{14}
Case 7: 48-year-old woman with CT performed for concern for pulmonary embolism. What is your diagnosis?
Case 7: 48-year-old woman with CT performed for concern for pulmonary embolism. What is your diagnosis?

Findings: Axial contrast-enhanced CT image of the chest (a) shows emboli in bilateral pulmonary arteries (arrows). Axial image (b) shows an atrial septal aneurysm (arrow). Coronal reformatted image of the abdomen (c) shows a thrombus in the left common iliac artery (arrow).

Answer: Patent foramen ovale and paradoxical embolism.
Paradoxical Embolism in a Patient with Atrial Septal Aneurysm

- Paradoxical embolism implies thromboembolism originating in the venous vasculature that traverses through an intracardiac or pulmonary shunt into the systemic circulation.
- May result in neurologic deficits from ischemic stroke, chest pain from myocardial infarction, acute abdominal pain due to gastrointestinal ischemia, back pain and hematuria from renal infarction, or pulseless extremities from peripheral arterial occlusion.
- The most common intracardiac shunt is a patent foramen ovale (PFO), which can be found in up to 30% of otherwise normal hearts, with the prevalence decreasing with increasing age.
- An increase in right-sided heart pressures, such as after pulmonary embolism or other causes of pulmonary arterial hypertension, results in significant right-to-left shunt increasing the risk for paradoxical embolism.
- Patients with a PFO size >4 mm are at greater risk for paradoxical embolism.
- There is extensive evidence documenting an increased risk of paradoxical embolism with the additional presence of an atrial septal aneurysm (ASA).
- The majority of patients with an ASA have a PFO (approximately 70%), and in these patients the PFO is usually larger than in patients without ASA.\(^{15}\)
Case 8: 64-year-old man with a cardiac mass. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Case 8: 64-year-old man with a cardiac mass. What is your diagnosis?

Findings: Axial CT image of the chest (a) shows a mass in the right atrium (arrow). Axial image of the abdomen (b) shows extensive infiltrative neoplasm in the right lobe of the liver. Axial image through the upper abdomen (c) shows the neoplasm invading the right hepatic vein and the inferior vena cava (arrow).

Answer: Hepatocellular carcinoma with vascular invasion extending into the right atrium.
Extension of Abdominal Neoplasm into the Right Atrium through the IVC

- The inferior vena cava (IVC) is the main conduit of venous return to right atrium (RA) from the abdominal viscera.
- Several abdominal malignancies can be complicated by extension and tumor thrombi to the IVC, and subsequently to the right atrium.
- Renal cell carcinoma (RCC) is the most common malignancy that extends into the IVC, with 4-10% of cases involving venous invasion.
- Adrenal cortical carcinoma is a rare malignancy with extension into the IVC seen in up to 30% of cases.
- Hepatocellular carcinoma often invades the portal venous system, however invasion into the hepatic veins and IVC occurs in 4-6% of patients.
- The imaging appearance of tumor thrombus is typically expansion of IVC lumen and enhancement of thrombus, and these features allow differentiation from bland thrombus.\textsuperscript{16}
Case 9: 49-year-old man with mediastinal mass. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Case 9: 49-year-old man with mediastinal mass. What is your diagnosis?

Findings: Axial CT image of the chest (a) shows a right paravertebral soft tissue mass (arrow). Axial image through the upper abdomen (b) demonstrates a small calcified splenic remnant from autosplenectomy (arrow). Coronal reconstruction image (c) again shows the right paravertebral mass (pink arrow) and splenic remnant (blue arrow) as well as coarsened trabeculation of the vertebral bodies.

Answer: Extramedullary hematopoiesis due to sickle cell disease.
Intrathoracic Extramedullary Hematopoiesis

- Extramedullary hematopoiesis (EMH) refers to the production of blood cells outside the bone marrow, occurring when there is inadequate production/quality of blood cells.
- The most common causes are myelofibrosis, diffuse osseous metastatic disease replacing bone marrow, leukemia, sickle cell disease, and thalassemia.
- Paraspinal masses are the most common site of EMH after hepatosplenomegaly, and occur most commonly in the thorax.
- One theory for the paraspinal location of EMH is the extrusion of bone marrow through the thinned cortex of the vertebral bodies seen in patients with hemoglobinopathies.
- The second most common thoracic manifestation is rib expansion, especially in patients with thalassemia.
- Rarer intrathoracic appearances of EMH include pulmonary nodules and masses, fibrosis, and interstitial infiltrates.¹⁷
Case 10: 62-year-old woman with lung nodules and knee pain. What is your diagnosis?
Case 10: 62-year-old woman with lung nodules and knee pain. What is your diagnosis?

Findings: Axial CT image of the chest in lung windows (a) shows multiple pulmonary nodules (arrows). Axial T2-weighted fat-suppressed FSE MR image (b) and sagittal T2-weighted fat-suppressed proton density MR image (c) of the knee show markedly thickened synovium (white arrows) and a small knee effusion (blue arrows).

Answer: Pulmonary rheumatoid nodules.
Pulmonary Manifestations of Rheumatoid Arthritis

- Rheumatoid arthritis (RA) is a systemic autoimmune process classically known for chronic, progressive, symmetrical erosive synovitis.
- There are multiple pleuropulmonary manifestations of RA, including RA associated interstitial lung disease (ILD), pulmonary nodules, large and small airway obstruction, pleural disease, and vascular disease including vasculitis and pulmonary hypertension.
- The most common pleuropulmonary manifestations of RA are ILD and pleural disease.
- RA-related ILD includes several histologic patterns including nonspecific interstitial pneumonia (NSIP), usual interstitial pneumonia (UIP), organizing pneumonia (OP), lymphocytic interstitial pneumonia (LIP), desquamative interstitial pneumonia (DIP) and acute interstitial pneumonia (AIP).
- Pleural disease can include exudative inflammatory pleural effusions and empyema.
- Upper airway obstruction can occur due to cricoarytenoid arthritis.
- Follicular bronchiolitis can cause centrilobular or peribronchial micronodules, bronchial dilatation and wall thickening.
- Rheumatoid nodules are the only pulmonary manifestation specific to RA on pathologic examination.
  - The nodules may develop necrosis and cavitation, rupture into the pleural space, and rarely create a bronchopleural fistula.\(^{18}\)
Case 11: 48-year-old woman with mediastinal mass. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Case 11: 48-year-old woman with mediastinal mass. What is your diagnosis?

Findings: Axial contrast-enhanced CT image of the chest (a) shows a large low-attenuation cystic paraesophageal mass (arrow). Axial images of the abdomen (b and c) show a dilated pancreatic duct (blue arrow) and a cystic lesion in the pancreatic body (pink arrow). Coronal reconstruction image (d) shows the cystic lesion extending from the pancreas to the mediastinum (asterisk).

Answer: Pancreatic pseudocyst with mediastinal extension.
Mediastinal Pancreatic Pseudocyst

• A pseudocyst represents the formation of a fibrous capsule around an unresorbed pancreatic fluid collection after 4-6 weeks.
• Pseudocysts complicate 20-25% of chronic pancreatitis cases and 7-15% of acute pancreatitis cases.
• Extra-abdominal extension of a pancreatic pseudocyst is rare.
• The characteristic finding is a low-attenuation cystic mass in the posterior or middle mediastinum in continuity with the pancreas and elevated amylase level on analysis of its contents.
• Mediastinal pseudocysts occur as a result of fluid tracking along fascial planes.
• The posterior mediastinum is the most common location of mediastinal pseudocysts, which occur as a result of pseudocyst fluid tracking through the esophagus and aortic hiatus.
• Mediastinal pseudocysts can cause compression of mediastinal structures such as the cardiac chambers, producing elevated cardiac filling pressures and congestive heart failure.
• Rupture can cause a pancreatic pleural effusion or cardiac tamponade if the pericardial sac is involved.19
Case 12: 34-year-old woman with recurrent episodic chest pain. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
Case 12: 34-year-old woman with recurrent episodic chest pain. What is your diagnosis?

Findings: Axial and sagittal CT images of the chest in soft tissue window (a and b) show a low attenuation cystic mass over the right diaphragm (arrows). Axial image in lung window (c) shows a right anterior pneumothorax (arrow). Axial CT image of the pelvis (d) shows two cystic lesions to the right of the uterus representing endometriomas (asterisks).

Answer: Catamenial pneumothorax due to thoracic endometriosis.
Thoracic Endometriosis Syndrome and Catamenial Pneumothorax

- Thoracic endometriosis syndrome (TES) refers to various clinical and radiological manifestations resulting from the presence and cyclical changes of functional endometrial tissue outside the uterine cavity within a thoracic structure (visceral/parietal pleura, lung parenchyma, airways, diaphragm).²⁰
- TES includes five entities grouped into two forms:
  - Pleural form: catamenial pneumothorax, non-catamenial endometriosis-related pneumothorax, and catamenial hemothorax
  - Pulmonary form: catamenial hemoptysis and lung nodules²¹
- The term catamenial pneumothorax (CP) refers to a spontaneous recurrent pneumothorax occurring in women of reproductive age in temporal relationship with menses.²¹
- The word “catamenial” is derived from the Greek word “katamenios,” meaning monthly occurrence.²¹
- The most widely accepted explanation for thoracic endometriosis is retrograde menstruation through the fallopian tubes, and endometrial cells in the peritoneal cavity follow the peritoneal circulation through the right paracolic gutter towards the subdiaphragmatic area.²⁰
- The air leakage causing catamenial pneumothorax may be caused by transdiaphragmatic passage of peritoneal air leaving the genital tract through the fallopian tubes, sloughing of endometrial implants from the visceral pleura with subsequent air leakage, and alveolar rupture due to prostaglandin-induced bronchiolar constriction or obstruction by bronchial endometrial implants.²⁰
Case 13: 33-year-old African-American man with chronic shortness of breath and altered mental status. What is your diagnosis?
Case 13: 33-year-old African-American man with chronic shortness of breath and altered mental status. What is your diagnosis?

Answer: Pulmonary and neurologic sarcoidosis.

Findings: Axial contrast-enhanced CT image of the chest (a) and coronal reconstruction image (b) in soft tissue window show multiple enlarged mediastinal and hilar lymph nodes (arrows). Coronal CT reconstruction image in lung window (c) shows multiple nodules (arrows) in both lungs in a perilymphatic distribution. Axial TI-weighted post-contrast image of the brain (d) demonstrates diffuse leptomeningeal enhancement (arrows).

Answer: Pulmonary and neurologic sarcoidosis.
Thoracic Manifestations of Sarcoidosis

- Sarcoidosis is a systemic disease affecting the lung in 90-95% of cases.\textsuperscript{22}
- Identification of the characteristic noncaseating granuloma is essential for diagnosis.\textsuperscript{22}
- Pulmonary sarcoidosis can present as a granulomatous interstitial pneumonia.\textsuperscript{22}
- Noncaseating granulomas collect and form nodular opacities within lymphatics in pleural interstitium, interlobular septa, bronchiovascular lymphatics, and intralobular lymphatics.\textsuperscript{22}
- Mediastinal lymph node enlargement is another key feature.\textsuperscript{22}
- Granulomas either resolve or leave behind fibrotic changes, and a progressive pulmonary fibrosis leads to end-stage sarcoidosis.\textsuperscript{22}
- Symptoms can include persistent cough, progressive dyspnea, chest pain, skin or eye symptoms, peripheral/intraabdominal lymphadenopathy, and arthritis.\textsuperscript{22}
- Less common extrapulmonary symptoms include splenomegaly, parotitis, and diabetes insipidus.\textsuperscript{22}
- Leptomeningeal involvement is a frequent manifestation of neurosarcoidosis and causes aseptic meningitis.
  - Contrast-enhanced T1-weighted imaging shows diffuse enhancement of the meningeal lesions.
  - Small enhancing nodules on the brain surface and in perivascular spaces can also be seen.\textsuperscript{23}
Case 14: 32-year-old man with mediastinal mass. What is your diagnosis?

CLICK FOR FINDINGS AND ANSWER
**Case 14: 32-year-old man with mediastinal mass. What is your diagnosis?**

**Findings:** Axial contrast-enhanced CT image of the chest (a) shows an enhancing anterior mediastinal mass (arrow). Axial image (b) shows an expansile lytic lesion in a right lateral rib (arrow). Axial image through the kidneys (c) shows calculi in the left kidney (arrow). Coronal CT reconstruction image (d) shows an expansile lytic lesion in the left proximal humerus (arrow).

**Answer:** Ectopic parathyroid adenoma and brown tumors.
Ectopic Parathyroid Adenoma

- Parathyroid adenoma is the most common cause of primary hyperparathyroidism, and 10% of these adenomas are ectopic.\textsuperscript{24}
- Hyperparathyroidism presents with hypercalcemia and commonly nephrolithiasis.\textsuperscript{24}
- Ectopic parathyroid glands have been attributed to abnormal migration during embryogenesis.\textsuperscript{25}
- The inferior parathyroid glands account for the majority of ectopic glands.\textsuperscript{25}
- Ectopic parathyroid glands are responsible for the majority of cases of recurrent hyperparathyroidism.\textsuperscript{24}
- Dual-phase $^{99m}$Tc-sestamibi has an high sensitivity (reported as 81%) for detecting ectopic parathyroid adenomas.\textsuperscript{24}
- Preoperative imaging localization is crucial for identification of certain ectopic parathyroid gland locations, such as submandibular or retrosternal, since it may alter the operative approach.\textsuperscript{25}
# Scoreboard

<table>
<thead>
<tr>
<th>Number of Cases Answered Correctly</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-14</td>
<td>Excellent job! You’re a budding Ben Felson.</td>
</tr>
<tr>
<td>9-11</td>
<td>Great work. You must be a thoracic radiologist.</td>
</tr>
<tr>
<td>6-8</td>
<td>Nice job. You can cover for the thoracic radiologist when she goes on vacation.</td>
</tr>
<tr>
<td>3-5</td>
<td>Not bad. Have you considered a fellowship in thoracic radiology?</td>
</tr>
<tr>
<td>0-2</td>
<td>You have the potential to be an outstanding neuroradiologist.</td>
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References


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