

## 2011 Imaging Criteria

Computed Tomography (CT), Chest<sup>(1, 2\*RIN, 3)</sup>

ICD-9-CM: 87.41

CPT: 71250, 71260, 71270, 71275

I/O Setting: Outpatient

## INDICATION(S)

- 100 Lung abnormality by CXR
- 200 Pneumonia by CXR
- 300 Lung cancer screening **and** secondary medical review required
- 400 Cancer
- 500 Suspected pulmonary embolus (PE) ♦
- 600 Mediastinal mass by CXR
- 700 Hilar enlargement by CXR
- 800 Elevated diaphragm with CXR nondiagnostic for etiology of elevation
- 900 New pleural effusion by CXR
- 1000 Hemoptysis
- 1100 Vocal cord paralysis and CXR nondiagnostic for etiology of paralysis
- 1200 Lung abscess by CXR
- 1300 Evaluation for lung/mediastinal metastases
- 1400 Known lung/mediastinal tumor
- 1500 Suspected interstitial lung disease
- 1600 Esophageal cancer
- 1700 Suspected thoracic aortic dissection ♦
- 1800 Suspected thoracic/thoracoabdominal aneurysm
- 1900 Paracardiac mass
- 2000 Chest trauma ♦
- 2100 Preoperative study for pneumothorax repair
- 2200 Suspected thymoma in patient with myasthenia gravis
- 2300 Suspected bronchiectasis

- 100 Lung abnormality by CXR [One]
- 110 Lung nodule/mass [One]<sup>(4, 5, 6)</sup>
  - 111 Age ≥ 35
  - 112 Size > 3 cm
  - 113 Enlarged compared to prior CXR<sup>(7)</sup>
  - 114 Suspicious mass in patient age < 35 [One]<sup>(8\*MDR)</sup>
    - 1 Equivocal calcification
    - 2 Eccentric calcification

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- 3 No calcification
- 115 CXR nondiagnostic for characteristics of lung nodule/mass<sup>(9)</sup>
- 116 Smoker
- 117 Malignancy elsewhere by Hx
- 120 Atelectasis by CXR **[One]**<sup>(10)</sup>
  - 121 Lobar atelectasis > 2 days
  - 122 Segmental atelectasis > 2 wks
  - 123 Entire lung field
- 130 Giant bulla/localized emphysema by CXR<sup>(11, 12)</sup>
  
- 200 Pneumonia by CXR **[One]**
  - 210 Pneumonia unimproved **after** Abx ≥ 2 courses **[One]**<sup>(13)</sup>
    - 211 Persistent temperature > 100.4 F(38.0 C)
    - 212 O<sub>2</sub> sat/Po<sub>2</sub> unimproved/worsening with supplemental O<sub>2</sub>
  - 220 Pneumonia not clearing by CXR **[One]**<sup>(14)</sup>
    - 221 Unimproved at 4 wks by repeat CXR
    - 222 Not resolved at 8 wks by repeat CXR<sup>(15)</sup>
  - 230 Immunocompromised host **[One]**<sup>(16, 17)</sup>
    - 231 Continued/worsening symptoms after IV Abx Rx ≥ 2 days
    - 232 CXR worsening after IV Abx Rx ≥ 5 days
  - 240 Recurrent pneumonia at same site w/in 6 mos<sup>(18)</sup>
  
- 300 Lung cancer screening **and** secondary medical review required<sup>(19\*MDR)</sup>
  
- 400 Cancer **[One]**<sup>(20\*RIN)</sup>
  - 410 Cancer by bronchoscopy<sup>(21)</sup>
  - 420 Cancer by sputum cytology **[Both]**<sup>(22)</sup>
    - 421 CXR nondiagnostic for etiology of cancer
    - 422 Upper airway normal by PE
  
- 500 Suspected pulmonary embolus (PE) **[Both]** ♦<sup>(23\*RIN, 24, 25, 26, 27, 28)</sup>
  - 510 Sx/findings **[One]**
    - 511 Sudden onset of dyspnea<sup>(29)</sup>
    - 512 Pleuritic chest pain
    - 513 Hypoxia on RA **[One]**
      - 1 Po<sub>2</sub> < 60 mmHg(8.0 kPa)
      - 2 O<sub>2</sub> sat < 90%<sup>(30)</sup>
    - 514 Hemoptysis
    - 515 Suspected DVT by PE and LE duplex US/IPG nondiagnostic for DVT **[One]**<sup>(31, 32, 33)</sup>
      - 1 Heart rate > 100
      - 2 New cough

- 516 Known DVT with positive LE duplex US/IPG<sup>(31)</sup>  
 520 CXR nondiagnostic for etiology of Sx/findings<sup>(34)</sup>
- 600 Mediastinal mass by CXR<sup>(35, 36)</sup>
- 700 Hilar enlargement by CXR<sup>(37)</sup>
- 800 Elevated diaphragm with CXR nondiagnostic for etiology of elevation<sup>(38)</sup>
- 900 New pleural effusion by CXR **[One]**  
 910 Malignant cells by thoracentesis with no known malignancy<sup>(39, 40)</sup>  
 920 Exudative pleural effusion **[All]**<sup>(41)</sup>  
 921 CXR nondiagnostic for etiology of effusion  
 922 Thoracentesis nondiagnostic  $\geq 2x$  for etiology of effusion<sup>(42)</sup>  
 923 No known malignancy elsewhere  
 930 Preoperative study for loculated effusion prior to surgery/chest tube insertion
- 1000 Hemoptysis **[One]**<sup>(30, 43, 44)</sup>  
 1010 Acute chest injury **[One]**<sup>(45)</sup>  
 1020 Nontraumatic with  $\geq 50$  cc bright red blood in 24 hrs **[One]**<sup>(46, 47, 48)</sup>  
 1021 Mass by CXR  
 1022 CXR normal/nondiagnostic for etiology of hemoptysis  
 1030 Blood-streaked sputum **[One]**<sup>(49\*RIN, 50)</sup>  
 1031 High-risk patient with CXR nondiagnostic for etiology of blood-streaked sputum **[One]**<sup>(51)</sup>  
 -1 Smoking by Hx  
 -2 Known malignancy elsewhere by Hx  
 1032 Nonsmoker **[Both]**<sup>(52)</sup>  
 -1 Findings **[One]**  
 A)  $\geq 2$  episodes  
 B) Continued blood-streaked sputum after Abx Rx  $\geq 10$  days  
 -2 CXR and upper airway exam nondiagnostic for etiology of blood-streaked sputum
- 1100 Vocal cord paralysis and CXR nondiagnostic for etiology of paralysis
- 1200 Lung abscess by CXR **[One]**<sup>(53)</sup>  
 1210 Otherwise healthy patient w/o prior aspiration pneumonia by Hx<sup>(54)</sup>  
 1220 Immunocompromised host<sup>(16)</sup>  
 1230 Patient with aspiration Hx **[Both]**  
 1231 Prior aspiration pneumonia  
 1232 Abscess unimproved **[One]**

- 1 Temperature > 100.4 F(38.0 C) after > 1 wk of IV Abx Rx
- 2 Abscess w/o change by CXR after > 2 wks of IV Abx Rx<sup>(55)</sup>

1300 Evaluation for lung/mediastinal metastases **[One]**1310 Lung metastases resection considered **[All]**<sup>(56)</sup>

- 1311 Known nonpulmonary malignancy
- 1312 Metastatic pulmonary nodule(s) by CXR
- 1313 No evidence of other metastases

1320 Prior to Rx of primary cancer **[One]**

- 1321 Testicular/germ cell cancer
- 1322 Non-Hodgkin's/Hodgkin's lymphoma<sup>(57)</sup>
- 1323 Renal cell cancer with CXR normal
- 1324 Sarcoma with CXR normal

1400 Known lung/mediastinal tumor **[One]**<sup>(58)</sup>1410 No new/worsening Sx/findings **[One]**

- 1411 Periodic assessment during chemotherapy/radiation Rx<sup>(59)</sup>
- 1412 After chemotherapy/radiation Rx completed<sup>(60)</sup>
- 1413 Periodic assessment **after** Rx **[One]**<sup>(61)</sup>
  - 1 Testicular/germ cell cancer<sup>(62)</sup>
  - 2 Non-Hodgkin's/Hodgkin's lymphoma<sup>(63)</sup>

1420 New/worsening Sx/findings **[One]**

- 1421 Abnormality by CXR
- 1422 Dyspnea<sup>(29)</sup>
- 1423 Cough/wheeze
- 1424 Chest pain
- 1425 Hoarseness
- 1426 Horner's syndrome<sup>(64)</sup>
- 1427 Hemoptysis<sup>(30)</sup>
- 1428 SIADH<sup>(65)</sup>
- 1429 Hypercalcemia<sup>(66)</sup>

1430 Tumor marker rise with germ cell cancer<sup>(67)</sup>1500 Suspected interstitial lung disease **[All]**<sup>(68)</sup>1510 Hx suggestive of interstitial lung disease<sup>(69)</sup>1520 Sx/findings **[One]**

- 1521 Progressive/persistent dyspnea<sup>(29, 70)</sup>
- 1522 Chronic cough<sup>(71)</sup>
- 1523 PFT abnormality **[One]**<sup>(72)</sup>
  - 1 Decreased FVC
  - 2 Decreased TLC

- 3 Decreased DLCO
- 1530 CXR [One]<sup>(73)</sup>
  - 1531 Suggestive of interstitial lung disease<sup>(74)</sup>
  - 1532 Nondiagnostic for etiology of Sx/findings
- 1600 Esophageal cancer [One]<sup>(75\*MDR)</sup>
  - 1610 Initial evaluation<sup>(76)</sup>
  - 1620 New/worsening Sx/findings post resection [One]
    - 1621 Dysphagia<sup>(77)</sup>
    - 1622 Dyspnea<sup>(29)</sup>
    - 1623 Chest pain
    - 1624 Cough
    - 1625 GI bleeding
    - 1626 Weight loss
    - 1627 Neck/head pain w/o other cause
  - 1630 Follow-up known nonresectable cancer after Rx [One]
    - 1631 Periodic assessment during chemotherapy/radiation Rx<sup>(59)</sup>
    - 1632 After chemotherapy/radiation Rx completed<sup>(60)</sup>
    - 1633 New/worsening Sx/findings [One]
      - 1 Dysphagia<sup>(77)</sup>
      - 2 Dyspnea<sup>(29)</sup>
      - 3 Chest pain
      - 4 Cough
      - 5 GI bleeding
      - 6 Weight loss
      - 7 Neck/head pain w/o other cause
- 1700 Suspected thoracic aortic dissection [One] ♦<sup>(78, 79, 80)</sup>
  - 1710 Chest pain by Hx and ECG w/o ischemic changes<sup>(81)</sup>
  - 1720 Acute HF with newly discovered AR<sup>(82)</sup>
  - 1730 Chest pain with CNS event
  - 1740 Chest pain with pulse deficit
  - 1750 Chest pain with > 10 mmHg difference in BP between arms
  - 1760 Chest pain with wide mediastinum by CXR
- 1800 Suspected thoracic/thoracoabdominal aneurysm [One]<sup>(83, 84)</sup>
  - 1810 Enlarged aorta w/o symptoms [One]
    - 1811 Ascending aorta with diameter ≥ 5 cm by TTE
    - 1812 Aortic arch/descending aorta with diameter ≥ 3.5 cm by CXR
    - 1813 Abnormal contour of ascending/descending aorta by CXR
  - 1820 Sx/findings [One] ♦<sup>(85)</sup>

- 1821 Chest pain by Hx and ECG w/o ischemic changes
- 1822 Chest pain with CNS event
- 1823 Chest pain with pulse deficit

1900 Paracardiac mass [**One**]<sup>(86, 87)</sup>

- 1910 By CXR
- 1920 By TTE

2000 Chest trauma [**One**] ♦<sup>(88)</sup>

- 2010 Wide mediastinum by CXR<sup>(89)</sup>
- 2020 CXR equivocal<sup>(90)</sup>

2100 Preoperative study for pneumothorax repair [**Both**]

2110 VAT planned<sup>(91)</sup>

2120 Pneumothorax [**One**]<sup>(92)</sup>

2121 Spontaneous pneumothorax [**One**]

-1 Primary [**One**]<sup>(93)</sup>

- A) ≥ 2 episodes same lung
- B) 1 episode contralateral lung
- C) 1 episode and high-risk occupation/hobby<sup>(94)</sup>
- D) Persistent air leak after > 4 days of thoracostomy tube drainage

-2 Secondary<sup>(95, 96)</sup>

-3 Bilateral ♦

2122 Traumatic/iatrogenic pneumothorax with persistent air leak after > 1 wk of thoracostomy tube drainage

2200 Suspected thymoma in patient with myasthenia gravis<sup>(97, 98)</sup>

2300 Suspected bronchiectasis [**Both**]<sup>(99)</sup>

2310 Sx/findings [**One**]

- 2311 Cough
- 2312 Sputum production
- 2313 Dyspnea<sup>(29)</sup>
- 2314 Hemoptysis<sup>(30)</sup>
- 2315 PFTs abnormal

2320 Bronchiectasis by CXR<sup>(100)</sup>

## Notes

**(1)**

These criteria include the following procedures:  
Computed Tomography Angiography (CTA), Chest  
Helical/Spiral Computed Tomography (CT), Chest  
Multi-Detector Computed Tomography (MDCT), Chest

**(2)-RIN:**

**For CT of the heart, see the "Computed Tomography (CT), Cardiac" criteria subset.**

**(3)**

CT of the chest will generally include the upper abdomen, especially when performed for the evaluation of trauma or cancer staging.

**(4)**

CT is the preferred imaging study used to evaluate a lung lesion (Prenzel et al., Chest 2003; 123(2): 463-467). While false positive and false negative CT assessment of the nodes can occur, CT can identify nodes which would be inaccessible with mediastinoscopy or with thoracotomy. Superior sulcus (Pancoast) tumors can be visualized with CT; however, the extent of the tumor is better visualized with MRI.

**(5)**

Approximately 35% of solitary pulmonary nodules are due to primary malignancy, with an additional 23% diagnosed as pulmonary metastasis. Most nodules > 3 cm are malignant (Tan et al., Chest 2003; 123(1 Suppl): 89S-96S). Criteria for a benign nodule include (Kim et al., J Nucl Med 2007; 48(2): 214-220; Hartman, Radiol Clin North Am 2005; 43(3): 459-465, vii):

- A benign pattern of calcification in the nodule
- Stability of size over the preceding 2 years

**(6)**

If the CT is equivocal, additional testing is required. PET scanning is helpful in characterizing a benign from a malignant lesion.

**(7)**

No further workup is needed if the previous CXR was performed more than 2 years ago and the lesion is unchanged; in this case, the mass is probably benign (Gould et al., Chest 2007; 132(3 Suppl): 108S-130S; Tan et al., Chest 2003; 123(1 Suppl): 89S-96S).

**(8)-MDR:**

**If the patient is < 35, a nonsmoker, and the nodule exhibits dense central, concentric, or diffuse calcifications, it is likely that the lesion is benign (Tan et al., Chest 2003; 123(1 Suppl): 89S-96S; McLoud, Clin Chest Med 2002; 23(1): 123-136). Requests for a CT in these cases require secondary medical review.**

**(9)**

CT is better than CXR in determining nodule size, shape, growth rate, and calcification pattern, and has increased sensitivity over CXR for the detection of multiple nodules (Gould et al., Chest 2007; 132(3 Suppl): 108S-130S).

**(10)**

Whether to perform bronchoscopy or CT for the initial evaluation of atelectasis is dependent upon the patient's clinical stability. In stable patients, performing CT first allows evaluation of the mediastinum and directs attention to potential areas that would require biopsy when a bronchoscopy is performed. Furthermore, CT may reveal previously undiagnosed pathology and better defines the extent of known disease. At times, however, atelectasis can cause acute hypoxia requiring urgent bronchoscopy to reopen the collapsed portion of lung parenchyma.

**(11)-DEF:**

A bulla is an air pocket > 1 cm in diameter.

**(12)**

CT is performed to rule out an obstructive lesion as a cause for the localized emphysema.

**(13)**

McKesson consultants suggest at least two separate trials of antibiotic therapy and reculturing of sputum before progressing to chest CT. Trials may be limited to 72 hours each, depending on the severity of the situation and clinical judgment.

**(14)**

Patients with mild to moderate community acquired pneumonia may have symptoms that persist up to 4 weeks (El Moussaoui et al., Chest 2006; 130(4): 1165-1172).

**(15)**

If residual CXR findings are minimal at 8 weeks, some providers may choose to wait for complete resolution (without performing CT). However, proceeding with CT to assess for occult malignancy is reasonable.

**(16)**

Immunocompromised hosts are individuals whose immune system is defective either because of a primary underlying immunodeficiency disorder or because of the administration of medications that suppress the immune response.

**(17)**

Whether to perform a CT or bronchoscopy first for an immunocompromised patient with pneumonia is a matter of clinical judgment.

**(18)**

Recurrent pneumonia is seen in patients with immune deficiency (e.g., HIV infection), systemic disease (e.g., DM), malignancy, and cystic fibrosis.

**(19)-MDR:**

**The evidence regarding the efficacy of CT for screening lung cancer is controversial. Two studies by the same lead author reported early detection of lung cancer at a curable stage which resulted in a survival benefit (Henschke et al., N Engl J Med 2006; 355(17): 1763-1771; Henschke et al., Clin Imaging 2004; 28(5): 317-321). Interpretation of these studies is hampered by the potential for lead time bias. Two other studies failed to identify a survival benefit in high-risk patients undergoing lung cancer screening; the detection rate of benign nodules was high and led to unnecessary invasive diagnostic procedures (Bach et al., JAMA 2007; 297(9): 953-961; Swensen et al., Radiology 2005; 235(1): 259-265). Due to the potential for false positive results, unnecessary invasive procedures with the potential for harm, and an unclear survival benefit, requests for CT to screen for lung cancer require secondary medical review.**

**(20)-RIN:**

**These criteria do not address the use of CT for lung cancer screening; for criteria covering CT and lung cancer screening, see indication 300 in this subset.**

**(21)**

CT is performed for staging.

**(22)**

Whether to perform CT or bronchoscopy for further evaluation of cancer diagnosed by sputum cytology is a matter of clinical judgment. Dysplasia diagnosed by sputum cytology should be evaluated with bronchoscopy and CXR to confirm the diagnosis. CT is not indicated for the evaluation of dysplasia if bronchoscopy, CXR, and the upper airway are normal.

**(23)-RIN:**

**These criteria address the use of helical CT or CT angiography paired with venous phase imaging (CTA-CTV) for evaluating suspected PE. Imaging with conventional CT has not proven effective in diagnosing PE.**

**(24)-DEF:**

Pulmonary embolus (PE) is the lodging of a blood clot in a pulmonary artery resulting in obstruction of the blood flow through the lung.

**(25)**

Helical CT or CTA is used for evaluating suspected PE. When CTA is coupled with CTV, it has a sensitivity of 90% and specificity of 95% for detecting PE (Clemens and Leeper, Am J Med 2007; 120(10 Suppl 2): S2-12; Stein et al., N Engl J Med 2006; 354(22): 2317-2327).

**(26)**

V/Q scan had been the primary diagnostic tool for detecting PE. With advances in technology, availability, and accuracy, CT has become the preferred imaging test for evaluating suspected PE. V/Q scan is still considered an appropriate imaging study for patients that have a dye allergy, are pregnant or nursing, or have moderate to severe renal failure (Sostman et al., Radiology 2008; 246(3): 941-946; Clemens and Leeper, Am J Med 2007; 120(10 Suppl 2): S2-12).

**(27)**

Risk factors for PE include smoking, HTN, HF, CVA, hypercoagulability, history of venous thromboembolism, surgery requiring more than 30 minutes of anesthesia, immobilization, pregnancy or recent delivery, the use of OCPs or HRT, obesity, malignancy, IBD, or fracture of the pelvis, femur, or tibia. There is also evidence of a genetic predisposition in some cases (Fedullo and Tapson, N Engl

J Med 2003; 349(13): 1247-1256; Goldhaber and Elliott, Circulation 2003; 108(22): 2726-2729; Wells and Rodger, Clin Chest Med 2003; 24(1): 13-28).

**(28)**

D-dimer assay is a screening test for patients with suspected PE. Several D-dimer assays are available with varying sensitivities and specificities for evaluating PE. The ELISA assays are currently the most sensitive. A positive D-dimer test is insufficient to diagnose a PE due to its low specificity and further work up may be necessary. A normal D-dimer test in combination with a low to moderate pretest probability can rule out PE (Clemens and Leeper, Am J Med 2007; 120(10 Suppl 2): S2-12; Kluetz and White, Radiol Clin North Am 2006; 44(2): 259-271, ix).

**(29)-DEF:**

Dyspnea is defined as an uncomfortable sensation when breathing.

**(30)-DEF:**

Hemoptysis is the coughing up of blood.

**(31)-DEF:**

Deep venous thrombosis (DVT) is complete or partial occlusion of a deep vein by thrombus and generally presents as swelling, induration, warmth, or tenderness of the extremity.

**(32)**

DVTs remain confined to the calf without propagating or embolizing in approximately 70% to 80% of cases and generally undergo spontaneous recanalization. Calf vein thrombosis rarely causes PE unless it first extends into the popliteal or femoral veins. If untreated, nearly half of all patients with a proximal DVT will develop a PE (Dalen, Chest 2002; 122(4): 1440-1456).

**(33)**

These criteria address patients with physical examination findings suggestive of DVT, despite a nondiagnostic imaging study. Although tachycardia and cough are nonspecific for PE, their presence in such patients is sufficient justification for further evaluation.

**(34)**

CXR is obtained to exclude pulmonary pathology other than PE (e.g., HF, pneumonia) that might be responsible for the presenting symptoms. Findings noted on the CXR of patients with acute PE are cardiomegaly, pleural effusion, and an elevated hemidiaphragm (Chunilal et al., JAMA 2003; 290(21): 2849-2858). In 10% to 15% of patients with acute PE, CXR detects no abnormalities (Powell and Muller, Clin Chest Med 2003; 24(1): 29-38, v).

**(35)**

The mediastinum is divided into the anterior, middle, and posterior mediastinum. Common lesions in the anterior mediastinum are thymomas, teratomas, lymphomas, and thyroid masses. In the middle mediastinum, vascular masses, enlarged lymph nodes, and pleurocardial and bronchogenic cysts are the most common. Neurogenic tumors, meningoceles, gastroenteric cysts, and gastroenteric fistulae may be found in the posterior mediastinum.

**(36)**

For an upper mediastinal mass suspected to be the thyroid, a thyroid scan is a less expensive study than a CT. The thyroid scan should be performed prior to the CT, because the contrast material given during the chest CT can interfere with the RAI scan. For suspected neural tumors, which are generally located in the posterior mediastinum, MRI is the preferred study.

**(37)**

CT is performed to better delineate enlarged hilar nodes and to assess other mediastinal nodes.

**(38)**

CT should include the neck to exclude proximal phrenic nerve compression.

**(39)**

CT is indicated to diagnose primary lung cancer or less commonly, mesothelioma; such diagnoses will guide therapy. If the patient is known to have cancer and is found to have a malignant effusion, further imaging with CT will not change therapy.

**(40)**

Malignant effusions are most commonly associated with lung cancer, breast cancer, and lymphoma.

**(41)-DEF:**

An exudative effusion is defined by one of the following:

- Pleural fluid to serum total protein ratio > 0.5
- Pleural fluid to serum LDH ratio > 0.6

- Pleural fluid LDH  $\geq$  2/3 of upper limit of normal serum LDH

**(42)**

Exudative effusions can be found in numerous conditions, but are most commonly associated with infection or malignancy (Light, Clin Chest Med 2006; 27(2): 309-319; Porcel and Light, Am Fam Physician 2006; 73(7): 1211-1220). Malignant cells are not reliably detected on the first analysis of the pleural fluid; the yield increases as much as 27% after two thoracenteses (Maskell and Butland, Thorax 2003; 58 Suppl 2: ii8-17).

**(43)**

Other sites of bleeding in the nasopharynx and upper GI tract should be considered prior to assuming a pulmonic source; bleeding from these other sites is more common than true hemoptysis.

**(44)**

The seriousness of the cause of hemoptysis is not always correlated with the volume of expectorated blood or the duration of symptoms (Corder, Emerg Med Clin North Am 2003; 21(2): 421-435).

**(45)**

Hemoptysis secondary to trauma may be caused by a transected bronchus or vascular injury which require surgical repair to prevent lung tissue loss. CXR in this instance will often reveal pneumomediastinum.

**(46)**

Whether to perform bronchoscopy or CT as the initial test in this setting is a matter of clinical judgment. In the stable patient, CT may be preferred as the initial study because of its ability to diagnose abnormalities such as peripheral lung masses and bronchiectasis. In addition, CT can be performed rapidly, is noninvasive, and is more cost-effective than other studies. In patients with massive hemoptysis and hemodynamic compromise, however, urgent bronchoscopy is preferred to localize the bleeding source and control bleeding through treatments such as laser coagulation and bronchial tamponade (Bruzzi et al., Radiographics 2006; 26(1): 3-22).

**(47)**

Nontraumatic hemoptysis may be caused by a variety of pathologies and may range from minimal blood-streaked sputum to massive pulmonary hemorrhage. Common causes of blood-streaked sputum include bronchogenic carcinoma and bronchitis, with more significant blood loss associated with bronchiectasis and TB. Even minimal hemoptysis is cause for concern in patients at high risk for malignancy. In the immunocompromised patient, invasive fungal infections such as mucormycosis and aspergillosis can present with blood-streaked sputum, eventually leading to massive hemorrhage and death (Bruzzi et al., Radiographics 2006; 26(1): 3-22).

**(48)**

50 cc of bright red blood is approximately 3 tablespoons.

**(49)-RIN:**

**If the CXR reveals a mass, see indication 100 within this criteria subset. For pneumonia by CXR, see indication 200 within this criteria subset.**

**(50)**

Blood-streaked sputum refers to scant blood streaking in a purulent sputum sample.

**(51)**

Approximately 4% to 6% of patients presenting with blood-streaked sputum and a normal CXR have lung cancer (Traill et al., Eur J Radiol 2003; 45(1): 39-48). Whether to perform bronchoscopy or CT as the initial test in this setting is a matter of clinical judgment. Bronchoscopy allows direct visual examination of the endobronchial tree and collection of histologic samples, but is not useful for detecting small tumors within the lung parenchyma. CT may detect both endobronchial and parenchymal tumors, but does not allow tissue confirmation of abnormal findings.

**(52)**

Blood-streaked sputum in nonsmokers is most often caused by infection, therefore empiric antibiotic treatment for bronchitis is warranted prior to evaluation by CT or bronchoscopy. Treatment is usually aimed at common respiratory pathogens (*Haemophilus influenzae*, *S. pneumoniae*, *Mycoplasma pneumoniae*) and can include amoxicillin, erythromycin and its derivatives (e.g., clarithromycin), or trimethoprim-sulfamethoxazole (e.g., Bactrim). *B. pertussis*, a highly contagious respiratory infection, has experienced a resurgence in the U.S. and is treated with a macrolide or sulfa drug. When there is a recurrence of blood-streaked sputum without evidence of infection, or persistent blood-streaked sputum following a course of antibiotic treatment, CT or bronchoscopy is indicated to determine the etiology.

**(53)**

Thick-walled abscesses are either necrotic malignant lesions or TB lesions. Thin-walled abscesses are likely to be secondary to pneumonia. Whether to perform bronchoscopy or CT as the initial test in this setting is a matter of clinical judgment.

**(54)**

It is very unusual for a healthy patient to develop a lung abscess. CT is indicated to exclude occult malignancy or foreign body.

**(55)**

Radiologic change includes reduction in size of the abscess, reduction in size of the surrounding infiltrate, or a lowering of the air fluid level indicating resorption of fluid.

**(56)**

CT is performed to exclude the presence of hilar or mediastinal adenopathy that would preclude surgical resection of lung metastases.

**(57)**

This may apply to an initial staging study or to a restaging for disease recurrence.

**(58)**

These criteria apply to both primary lung tumors and metastatic disease to the lung. McKesson consultants recommend following these lesions by CXR. Whether to perform CXR or CT is a matter of clinical judgment.

**(59)**

The assessment is generally not necessary more frequently than every two cycles of chemotherapy.

**(60)**

The assessment is generally performed about 6 weeks after radiation is completed or after the chemotherapy is completed.

**(61)**

Periodic assessment is performed for these tumors since early detection of recurrence and early treatment may improve outcome.

**(62)**

For the first 2 years, periodic assessment may be as frequent as every 6 weeks.

**(63)**

For the first 2 years, periodic assessment may be as frequent as every 12 weeks.

**(64)**

Symptoms of Horner's syndrome are caused by compression or disruption of the sympathetic chain, and include ptosis, pupillary constriction, and lack of sweating on one side of the face.

**(65)**

Syndrome of inappropriate antidiuretic hormone secretion (SIADH) may be seen with small cell carcinoma of the lung. An inappropriately low serum sodium in the setting of small cell carcinoma of the lung may be significant for increased tumor activity.

**(66)**

Non small cell carcinoma of the lung may produce a PTH-like hormone that results in an elevated serum calcium (Strewler, N Engl J Med 2000; 342(3): 177-185). A new increase in serum calcium may be a marker for increased tumor activity or recurrence and is an indication for imaging.

**(67)**

A rise in serum beta-HCG or AFP in the patient with a germ cell malignancy may indicate tumor activity in the absence of symptoms or other findings.

**(68)**

Interstitial lung diseases represent a heterogenous group of conditions which produce diffuse inflammation and fibrosis of the lung. Patients usually present with cough and progressive dyspnea. These symptoms are frequently mild, nonspecific, and slowly progressive in nature making an accurate diagnosis difficult (Brown, Chest 2006; 129(1 Suppl): 180S-185S). There are many causes of interstitial lung disease, which include viral infection, drug-induced pneumonitis, chemical hypersensitivity, ARDS, radiation therapy, vasculitis, sarcoidosis, connective tissue diseases, and idiopathic pulmonary fibrosis (Brown, Chest 2006; 129(1 Suppl): 180S-185S). Therapy varies depending on the specific condition; steroid therapy is utilized for sarcoidosis and hypersensitivity pneumonitis. A randomized controlled trial in patients with idiopathic pulmonary fibrosis demonstrated that the addition of high dose oral acetylcysteine to prednisone and azathioprine, preserved vital capacity and carbon monoxide diffusion lung capacity better than prednisone and azathioprine (Demedts et al., N Engl J Med 2005; 353(21): 2229-2242). Unfortunately, interstitial lung disease often responds poorly to available treatments with little improvement in survival and quality of life (du Bois, Clin Chest Med 2006; 27(1

Suppl 1): S17-25, v-vi). Patients with idiopathic pulmonary fibrosis require a comprehensive approach to management and early referral for transplantation (du Bois, Clin Chest Med 2006; 27(1 Suppl 1): S17-25, v-vi).

**(69)**

A history suggestive of interstitial lung disease may include a gradual onset of dyspnea and cough that progresses over a period of months. There are many causes of interstitial lung disease, including occupational or environmental exposures such as asbestos, coal dust, or contact with birds. Family history or medication use may suggest an immunocompromised state or a systemic hereditary disease that might involve the lungs.

**(70)**

Progressive dyspnea is often the presenting symptom of interstitial lung disease and is usually persistent for several months.

**(71)-DEF:**

Cough is generally classified according to its duration:

- Acute cough is a cough which persists  $\leq$  3 weeks
- Subacute cough persists between  $>$  3 weeks but  $\leq$  8 weeks
- Chronic cough persists  $>$  8 weeks

**(72)**

Interstitial lung disease typically causes restrictive PFT findings, with decreased FVC and TLC. Gas exchange is also frequently impaired, evidenced by a diminished DLCO. PFT abnormalities can vary, however, depending on the extent of the disease, as well as on pulmonary comorbidity (du Bois, Clin Chest Med 2006; 27(1 Suppl 1): S17-25, v-vi; Khalil and O'Connor, CMAJ 2004; 171(2): 153-160). Therefore, any of the listed PFT abnormalities is sufficient to fulfill this criterion.

**(73)**

Patients with a CXR suggestive of interstitial lung disease should receive further evaluation when this finding is associated with either symptoms or PFT abnormalities. CXR has limited value in distinguishing between the various etiologies of interstitial lung disease, and studies have shown high resolution CT to be superior to CXR and conventional CT in the detection and differential diagnosis of interstitial disease (Akira, Clin Chest Med 2008; 29(1): 117-131; Brown, Chest 2006; 129(1 Suppl): 180S-185S).

**(74)**

Findings on CXR that suggest idiopathic pulmonary fibrosis (IPF), one of the most common causes of interstitial lung disease, include diffuse bilateral reticulonodular opacities, predominantly at the bases and periphery of the lung, which can lead to reduced lung volume (du Bois, Clin Chest Med 2006; 27(1 Suppl 1): S17-25, v-vi).

**(75)-MDR:**

**If there is no medical or surgical therapy planned, secondary medical review is required.**

**(76)**

CT will provide information about lung metastases, as well as extension of the cancer of the middle or upper third of the esophagus into the trachea or left main bronchus. Such extension makes the cancer nonresectable.

**(77)**

Dysphagia is difficulty swallowing and represents impairment of the oral, pharyngeal, or esophageal stages of swallowing. Oropharyngeal dysphagia results from dysfunction of the oropharyngeal swallowing mechanism and may be associated with the sensation of impaired swallowing. Esophageal dysphagia may be secondary to motility disorders or due to obstructing lesions (Lind, Gastroenterol Clin North Am 2003; 32(2): 553-575).

**(78)-DEF:**

Aortic dissection occurs when a tear in the intima of the aorta allows blood to dissect between the intima and the medial layer of the aorta. Aortic dissections are classified as Type A (DeBakey Type 1 and 2), which involve the ascending aorta, or Type B (DeBakey Type 3), which originate in the arch or descending aorta but do not extend proximally to involve the ascending aorta.

**(79)**

Aortic dissection is an emergent condition requiring immediate hemodynamic control and surgical evaluation. Patients with dissection may present with chest pain, HF, or shock. The most common symptom is severe tearing or burning chest pain. The dissection can extend into the pericardium causing tamponade or can involve the aortic root with acute onset of aortic valve insufficiency or occlusion of the coronary arteries; these events can result in sudden death (Khalil et al., Crit Care Med 2007; 35(8 Suppl): S392-400).

**(80)**

A thoracic aortic dissection is suspected in patients with known atherosclerosis and HTN, in patients who have sustained chest trauma, or in patients with Marfan's syndrome. TEE, MRI, or CT may be performed to make the diagnosis. TEE can be performed quickly and can be performed at the bedside in unstable patients (Khalil et al., Crit Care Med 2007; 35(8 Suppl): S392-400; Shiga et al., Arch Intern Med 2006; 166(13): 1350-1356). MRI provides greater detail and accuracy, and may be preferred in stable patients, but scanning time is prolonged and direct patient observation is limited. CT offers reliability and speed of diagnosis; it is often the most readily available test and is the preferred modality for the urgent diagnosis of thoracic aortic dissection. The decision to proceed with TEE, MRI, or CT is a matter of clinical judgment and available resources.

**(81)**

Classically, chest pain associated with an aortic dissection radiates to the back. This pain may mimic the pain of an MI; ECG is performed to exclude myocardial ischemia.

**(82)**

Acute dissection of the thoracic aorta may result in AR and subsequent HF.

**(83)-DEF:**

Aneurysms are abnormal dilatations of blood vessels (usually arteries) that involve all three layers of the vessel wall (intima, media and adventitia) and communicate directly with the vessel lumen.

**(84)**

A suspected aneurysm can be evaluated by CT, MRI, or TEE. TEE will not be able to visualize the full abdominal extension of the aneurysm.

**(85)**

Patients with symptoms from an aneurysm may present with a new pulse deficit, unexplained hypotension, a CNS event, or an enlarged aorta by CXR. The chest pain may occur without any other findings and since the aneurysm is life-threatening, urgent evaluation is necessary.

**(86)**

Whether to perform CT or MRI in this setting is a matter of clinical judgment.

**(87)**

Paracardiac masses most commonly include vascular lesions, enlarged lymph nodes, or bronchogenic cysts. TB and metastatic disease to the pericardium may also be seen.

**(88)**

Trauma patients often receive a supine AP CXR early in their evaluation. If the patient's condition permits, an upright CXR may clarify equivocal findings seen on the initial film.

**(89)**

Aortogram has generally been the procedure of choice in this setting. Aortogram is preferred in patients with clinical findings strongly suggestive of aortic disruption (e.g., pulse deficit, unequal BPs in the arms). CXR findings suggestive of aortic disruption include an obscured aortic knuckle, displacement of the trachea or NG tube to the right, depression of the left main bronchus, or left-sided pleural fluid.

**(90)**

If the CXR is nondiagnostic (e.g., hematoma versus lung contusion) and the patient is undergoing another CT study (e.g., brain), chest CT may be a logical next step (Wall et al., Surg Clin North Am 2001; 81(6): 1375-1393).

**(91)**

Preoperative CT is used to localize blebs that may be responsible for recurrent pneumothorax. CT may also better define other potential etiologies of the pneumothorax prior to VAT and provides guidance for biopsy, if indicated. This is not necessary with an open thoracotomy since the blebs and parenchyma can be directly visualized at surgery.

**(92)-DEF:**

A pneumothorax is a collection of air or gas in the pleural space, resulting in partial or complete collapse of the lung. It may occur spontaneously, secondary to trauma, or may be iatrogenic (e.g., needle biopsy of lung lesion).

**(93)-DEF:**

A primary pneumothorax is a pneumothorax that occurs in patients without underlying lung disease.

**(94)**

A person engaged in a high-risk occupation or hobby (e.g., pilot, diver) is a candidate for surgical treatment after one episode (Noppen et al., *Respiration* 2003; 70(4): 431-438; Baumann et al., *Chest* 2001; 119(2): 590-602).

**(95)-DEF:**

A secondary pneumothorax is a pneumothorax that occurs in patients with underlying lung disease, most often COPD.

**(96)**

In patients with lung disease, surgery is recommended following the first episode of pneumothorax to prevent potentially serious complications from a pneumothorax recurrence. Surgery is preferred to sclerosis because of its lower recurrence rate. Sclerosis may be used in patients that refuse surgery or are at high surgical risk (Noppen et al., *Respiration* 2003; 70(4): 431-438; Baumann et al., *Chest* 2001; 119(2): 590-602).

**(97)-DEF:**

Myasthenia gravis is an autoimmune disorder in which antibodies bind to skeletal muscle acetylcholine receptors. As a result of antibody binding to the neuromuscular junction, neural stimulation of muscle is impaired, with resultant fatigability and weakness.

**(98)**

A thymoma (neoplastic enlargement of the thymus gland) is associated with myasthenia gravis. Chest CT should be done on all patients with confirmed myasthenia gravis to exclude the presence of a thymoma (Meriglioli and Sanders, *Lancet Neurol* 2009; 8(5): 475-490). Chest CT defines the lesion and helps to evaluate for evidence of metastasis (Rosado-de-Christenson et al., *Hematol Oncol Clin North Am* 2008; 22(3): 409-431).

**(99)**

Bronchiectasis, a chronic illness characterized by permanent and abnormal dilation of bronchi, can lead to recurrent cough, purulent sputum, and hemoptysis which can be massive. CT is indicated to confirm a diagnosis of bronchiectasis made by CXR.

**(100)**

Bronchiectasis may be suspected by the finding of dilated, thick-walled bronchi (most commonly involving the lower lobes) on CXR.