2011 Imaging Criteria

Magnetic Resonance Angiogram (MRA), Chest[1, 2]

ICD-9-CM: 88.42, 88.43, 88.44
CPT: 71555
I/O Setting: Outpatient

INDICATION(S)

100 Suspected pulmonary embolus (PE) ♦
200 Thoracic aorta dissection
300 Thoracic aorta aneurysm
400 Congenital anomaly of thoracic vasculature and CT angiography not planned

100 Suspected pulmonary embolus (PE) **[All]** ♦[3, 4, 5]
- 110 Sx/findings **[One]**
  - 111 Sudden onset of dyspnea[6]
  - 112 Pleuritic chest pain
  - 113 Hypoxia on RA **[One]**
    - -1 Po_2 < 60 mmHg(8.0 kPa)
    - -2 O_2 sat < 90%
  - 114 Hemoptysis[7]
  - 115 Suspected DVT by PE and LE duplex US/IPG nondiagnostic for DVT **[One]**[8, 9, 10]
    - -1 Heart rate > 100
    - -2 New cough
  - 116 Known DVT with positive LE duplex US/IPG[8]
- 120 CXR nondiagnostic for etiology of Sx/findings[11]
- 130 Chest CT/CTA **[One]**[12, 13]
  - 131 Nondiagnostic for PE
  - 132 CTA not feasible/contraindicated[14]

200 Thoracic aorta dissection **[One]**[15]
- 210 Suspected thoracic aortic dissection **[Both]** ♦[16, 17]
  - 211 CT angiography not planned/nondiagnostic[18]
  - 212 Clinical presentation **[One]**
    - -1 Chest pain by Hx and ECG w/o ischemic changes[19]
    - -2 Acute HF with newly discovered AR[20]
    - -3 Chest pain with CNS event
    - -4 Chest pain with pulse deficit
    - -5 Chest pain with > 10 mmHg difference in BP between arms
    - -6 Chest pain with wide mediastinum by CXR

220 Postoperative assessment[21]

300 Thoracic aorta aneurysm **[Both]**[15]
- 310 CT angiography not planned/nondiagnostic
- 320 Clinical presentation **[One]**
  - 321 Suspected thoracic/thoracoabdominal aneurysm **[One]**[22, 23]
    - -1 Enlarged aorta w/o symptoms **[One]**
      - A) Ascending aorta with diameter ≥ 5 cm by TTE
      - B) Aortic arch/descending aorta with diameter ≥ 3.5 cm by CXR
      - C) Abnormal contour of ascending/descending aorta by CXR
    - -2 Sx/findings **[One]** ♦[24]
      - A) Chest pain by Hx and ECG w/o ischemic changes
      - B) Chest pain with CNS event
      - C) Chest pain with pulse deficit
  - 322 Postoperative assessment

400 Congenital anomaly of thoracic vasculature and CT angiography not planned[25, 26, 27]

Notes

(1)
MRA is an application of MRI that produces images of blood vessels for noninvasive evaluation of the arterial as well as venous circulation. Unlike a conventional angiogram or CTA, MRA does not involve ionizing radiation or the administration of iodinated IV contrast which is nephrotoxic and can cause an allergic reaction in some patients. MRA is not usually performed in addition to an angiogram, but as a substitute for angiogram.

(2)
The following are examples of relative and absolute contraindications to the use of magnetic resonance imaging:
• Implanted devices that are electrically or magnetically activated (e.g., cardiac pacemakers, automatic cardioverter defibrillators, drug infusion pumps, cochlear implants)
• Ferromagnetic metal objects (e.g., cerebral aneurysm clips, intraocular metallic foreign body, prostheses, screws)
• Pregnancy, first trimester
• Renal insufficiency in cases when magnetic resonance imaging is performed with gadolinium-based contrast

(3)-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.

(4)
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).

(5)
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).

(6)-DEF:
Dyspnea is defined as an uncomfortable sensation when breathing.

(7)-DEF:
Hemoptysis is the coughing up of blood.

(8)-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.

(9)
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).

(10)
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.

(11)
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).

(12)

CT of the chest, oftentimes with angiography, is the preferred imaging study for the diagnosis of suspected PE. It is a relatively safe, noninvasive test that can be performed quickly in the emergency setting to directly identify the presence and extent of PE. In addition, it is able to show other conditions that can clinically mimic PE (e.g., pneumonia, lung abscess, pneumothorax, mediastinitis).

(13)
MRA for evaluation of suspected PE is most useful in cases where other diagnostic tests are equivocal and the use of contrast material or ionizing radiation are contraindicated (Stein et al., Chest 2003; 124(6): 2324-2328).

(14)
MRA is not appropriate for patients with contraindications for MRI. Contraindications to CTA are similar to those for angiography and include renal impairment (e.g., elevated creatinine) and iodine contrast allergy.

(15)
Chest MRA has been shown to be efficacious for assessment and follow-up of the thoracic aorta. It provides both arterial contrast and cross-sectional information related to the aorta (Vogt et al., Radiol Clin North Am 2003; 41(1): 29-41).

(16)-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.

(17)
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).

(18)
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). 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.

(19)
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.

(20)
Acute dissection of the thoracic aorta may result in AR and subsequent HF.

(21)
MRA has greater sensitivity and comparable specificity as CT for imaging aortic dissection and is the preferred method of imaging for postsurgical follow-up (Tatli et al., Radiol Clin North Am 2004; 42(3): 565-585, vi).

(22)-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.

(23)
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.

(24)
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.

(25)
MRA is useful for imaging abnormalities such as arch anomalies (e.g., right-sided arch, double arch) and aortic coarctation (Vogt et al., Radiol Clin North Am 2003; 41(1): 29-41).

(26)

Although aortic arch anomalies may present during childhood, many are not discovered until adulthood. Imaging may be appropriate as part of the postoperative evaluation related to congenital cardiovascular disease (Tatli et al., Radiol Clin North Am 2004; 42(3): 565-585, vi).

(27)

Whether to perform MRA or CT angiography is a matter of clinical judgment.