CLINICAL GUIDELINES

Chest Imaging Policy

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

CHEST IMAGING GUIDELINES	

ABBREVIATIONS for CHEST GUIDELINES

AAA	abdominal aortic aneurysm		
ACE	angiotensin-converting enzyme		
AVM	arteriovenous malformation		
BI-RADS	Breast Imaging Reporting and Database System		
BP	blood pressure	**BRCA**	tumor suppressor gene
CAD	computer-aided detection	**CBC**	Complete blood count
COPD	chronic obstructive pulmonary disease		
CT	computed tomography		
CTA	computed tomography angiography		
CTV	computed tomography venography		
DCIS	ductal carcinoma in situ	**DVT**	deep venous thrombosis
ECG	electrocardiogram	**EM**	electromagnetic
EMG	electromyogram	**FDA**	Food and Drug Administration
FDG	fluorodeoxyglucose	**FNA**	fine needle aspiration
GERD	gastroesophageal reflux disease		
GI	gastrointestinal		
HRCT	high resolution computed tomography		
IPF	idiopathic pulmonary fibrosis		
LCIS	lobular carcinoma in situ		
LFTP	localized fibrous tumor of the pleura		
MRA	magnetic resonance angiography		
MRI	magnetic resonance imaging		
MRV	magnetic resonance venography		
NCV	nerve conduction velocity		
PE	pulmonary embolus		
PEM	positron-emission mammography		
PET	positron emission tomography		
PFT	pulmonary function tests		
PPD	purified protein derivative of tuberculin		
RODEO	Rotating Delivery of Excitation Off-resonance MRI		
SPN	solitary pulmonary nodule		
SVC	superior vena cava		

CH-1~GENERAL GUIDELINES

CH-1~GENERAL GUIDELINES

A current clinical evaluation (within 60 days), which includes a relevant history and physical examination and appropriate laboratory studies and non-advanced imaging modalities, such as plain x-ray or ultrasound, are required prior to considering advanced imaging. Other meaningful contact (telephone call, electronic mail or messaging) by an established patient can substitute for a face-to-face clinical evaluation

A Pulmonary or Thoracic Surgical Specialist can be helpful in evaluating thoracic disorders.

CH-1.1 General Guidelines - Chest X-Ray

- ✓ A recent chest x-ray (generally within the last 60 days) that has been overread by a radiologist would be performed in many of these cases prior to considering advanced imaging.
- ✓ Identify and compare with previous chest films to determine presence and stability.
- ✓ Chest x-ray can help identify previously unidentified and may direct proper advanced imaging for:
  - Pneumothorax,
  - Pneumomediastinum,
  - Fractured ribs,
  - Acute and chronic infections, and
  - Malignancies.
- ✓ Exceptions to preliminary chest x-ray may include:
  - Supraclavicular lymphadenopathy
  - Known Bronchiectasis
  - Suspected Interstitial lung disease
  - Positive PPD or tuberculosis
  - Suspected Pulmonary AVM

CH-1.2 General Guidelines - Chest Ultrasound

- ✓ Chest ultrasound (CPT® 76604) includes transverse, longitudinal, and oblique images of the chest wall with measurements of chest wall thickness, and also includes imaging of the mediastinum.

Chest Ultrasound Coding Notes

- Chest ultrasound: CPT® 76604
- Breast ultrasound
  - CPT® 76641: unilateral, complete
  - CPT® 76642: unilateral, limited
  - CPT® 76641 and CPT® 76642 should be reported only once per breast, per imaging session.
- Axillary ultrasound: CPT® 76882 (unilateral); if bilateral, can be reported as CPT® 76882 x 2.

CH-1.3 General Guidelines - Chest CT

✓ Intrathoracic abnormalities found on chest x-ray, fluoroscopy, abdominal CT scan, or other imaging modalities may be further evaluated with chest CT with contrast (CPT® 71260).

- "Abnormalities" through these guidelines may include suspected lung or pleural nodules or masses, pleural effusion, adenopathy or other findings that are not considered benign.
- Lung nodule(s) identified incidentally on chest CTA without and with contrast (CPT® 71275), chest MRI without contrast (CPT® 71550), chest MRI without and with contrast (CPT® 71552) or chest MRA without and with contrast (CPT® 71555) can replace chest CT with contrast (CPT® 71260) or chest CT without contrast (CPT® 71250) as the initial dedicated study.
- See also: **CH-16~Solitary Pulmonary Nodule (SPN)**
- See also: **ONC-8.2 Non-Small Cell Lung Cancer, Suspected/Diagnosis**

✓ Chest CT without contrast (CPT® 71250) can be used for the following:

- Patient has contraindication to contrast
- Follow-up of pulmonary nodule(s)
- High Resolution CT (HRCT)
- Low-dose chest CT (CPT® G0297) may be approved for lung cancer screening if *all* of the following criteria are met:
  - Patient has not received a low-dose CT lung screening in less than 12 months; ***and***
  - Patient has NO signs or symptoms suggestive of underlying lung cancer, and is able and willing to undergo curative lung surgery; ***and***
  - Patient is between 55 and 80 years of age; ***and***
  - Patient has at least a 30 pack-year history of cigarette smoking; ***and***
  - Currently smokes or quit less than 15 years ago
  - Computer aided detection (CAD) has not been medically proven to be effective to improve the accuracy of CT scanning in screening for lung cancer and

therefore is considered **investigational**.

- Other circumstances as specified in the guidelines
- Low-dose chest CT (CPT® G0297) may be approved for lung cancer screening if *all* of the following criteria are met:

Screening Indications - Medicare	Imaging Study
All criteria below must be met for approval: • Patient has not received a low-dose CT lung screening in less than 12 months; ***and*** • Patient has NO signs or symptoms* suggestive of underlying lung cancer; ***and*** • Patient is between 55 and 77 years of age; ***and*** • Patient has at least a 30 pack-year history of cigarette smoking; ***and*** • Currently smokes or quit less than 15 years ago • A written order for LDCT lung cancer screening that includes counseling and shared decision making*	Low-Dose Chest CT without contrast (G0297)

*A written order for LDCT lung cancer screening that meets the following criteria:

- For the initial LDCT lung cancer screening service: the beneficiary must receive a written order for LDCT lung cancer screening during a lung cancer screening counseling and shared decision making visit, furnished by a physician [as defined in Section 1861(r)(1) of the Social Security Act (the Act)] or qualified non-physician practitioner (physician assistant, nurse practitioner, or clinical nurse specialist as defined in §1861(aa)(5) of the Act).
- For subsequent LDCT lung cancer screenings: the beneficiary must receive a written order, which may be furnished during any appropriate visit (for example: during the Medicare annual wellness visit, tobacco cessation counseling services, or evaluation and management visit) with a physician (as defined in Section 1861(r)(1) of the Act) or qualified non-physician practitioner (physician assistant, nurse practitioner, or clinical nurse specialist as defined in Section 1861(aa)(5) of the Act).
- A lung cancer screening counseling and shared decision making visit includes the following elements (and is appropriately documented in the beneficiary's medical records):

- Determination of beneficiary eligibility including age, absence of signs or symptoms of lung disease, a specific calculation of cigarette smoking pack-years; and if a former smoker, the number of years since quitting;
- Shared decision making, including the use of one or more decision aids, to include benefits, harms, follow-up diagnostic testing, over-diagnosis, false positive rate, and total radiation exposure;
- Counseling on the importance of adherence to annual LDCT lung cancer screening, impact of comorbidities and ability or willingness to undergo diagnosis and treatment;
- Counseling on the importance of maintaining cigarette smoking abstinence if former smoker, or smoking cessation if current smoker and, if appropriate, offering additional Medicare-covered tobacco cessation counseling services; and
- If appropriate, the furnishing of a written order for lung cancer screening with LDCT. Written orders for both initial and subsequent LDCT lung cancer screenings must contain the following information, which must also be documented in the beneficiaries' medical records:
  - Beneficiary date of birth,
  - Actual pack-year smoking history (number);
  - Current smoking status, and for former smokers, the number of years since quitting smoking;
  - Statement that the beneficiary is asymptomatic; and NPI of the ordering practitioner

✓ Chest CT without and with contrast (CPT® 71270) does not add significant diagnostic information above and beyond that provided by chest CT with contrast, unless a question regarding calcification, most often within a lung nodule, needs to be resolved.

Chest CT Coding Notes:

High resolution chest CT should be reported only with an appropriate code from the set CPT® 71250-CPT® 71270. No additional CPT® codes should be reported for the "high resolution" portion of the scan. The "high resolution" involves additional slices which are not separately billable.

CH-1.4 General Guidelines - Chest CTA (CPT® 71275)

- ✓ Chest CTA can be considered for suspected Pulmonary Embolism and Thoracic Aortic disease.
- ✓ CTA prior to minimally invasive or robotic surgery (see: **CD-1.10 in the Cardiac Imaging Guidelines**).

CH-1.5 General Guidelines-Chest MRI without and with contrast (CPT® 71552)

- ✓ Indications for chest MRI are infrequent and include concerns about CT contrast such as renal insufficiency or contrast allergy.
  - Clarification of some equivocal findings on previous imaging studies, which are often in the thymic mediastinal region or determining margin (vascular/soft tissue) involvement with tumor and determined on a case by case basis.
  - Certain conditions, including:
    - Chest wall mass (**CH-23~CHEST WALL MASS**)
    - Chest muscle tendon injuries (**MS-11~Muscle/Tendon Injuries**)
    - Brachial plexopathy (**PN-4~Brachial Plexus**) and
    - Thymoma (**ONC-10.2 Thymoma**)

CH-1.6 General Guidelines – Nuclear Medicine

- ✓ For nuclear medicine codes, see: **PEDCH-1.3 Pediatric Chest Imaging Modality General Considerations**

References

1. Moyer VA. Screening for lung cancer: U.S. Preventive Services Task Force Recommendation Statement. Annals of Internal Medicine, 2014; 160:330-338.
2. ACR Appropriateness Criteria® 1 Acute Nonspecific Chest Pain–Low Probability of CAD, 2015.

CH-2~LYMPHADENOPATHY

CH-2.1 Supraclavicular Region

- ✓ Ultrasound (CPT® 76535) is the initial study for palpable or suspected lymphadenopathy[1].
- ✓ Allows simultaneous ultrasound-guided fine needle aspiration (FNA) (CPT® 76942).
- ✓ If ultrasound is indeterminate, neck CT with contrast (CPT® 70491) or chest CT with contrast (CPT® 71260) can be performed.

Also see: **NECK-1~General Guidelines** in the Neck Imaging Guidelines

CH-2.2 Axillary Lymphadenopathy

There is no evidence-based support for advanced imaging of clinically evidenced axillary lymph adenopathy without biopsy[2, 3]. Most axillary adenopathy is infectious in primary care settings. Metastatic axillary involvement from a lung or chest primary is highly unusual (CT chest not often warranted).

- ✓ Localized axillary lymphadenopathy should prompt:
  - Ultrasound directed core needle biopsy or surgical excisional biopsy of the most abnormal lymph node if condition persists or malignancy suspected.
  - Search for adjacent hand or arm injury or infection, and
  - 3-4 week observation if benign clinical picture, and
  - Excisional biopsy of most abnormal lymph node if condition persists or malignancy suspected
  - No advanced imaging indicated
- ✓ Generalized axillary lymphadenopathy should prompt:
  - Ultrasound directed core needle biopsy or surgical excisional biopsy of the most abnormal lymph node if condition persists or malignancy suspected.
  - Diagnostic work-up, including serological tests, for systemic diseases, and
  - Excisional biopsy of most abnormal lymph node if uncertainty persists
  - See: **ONC-27~Lymphomas** in the Oncology Imaging Guidelines
- ✓ Occult Primary Cancer in axillary lymph node(s)
  - Breast MRI (CPT® 77059) can be performed if breast cancer is suspected, and if physical exam and mammography are negative. Otherwise, imaging of other possible primary sites are led by symptomatology, and risk factors.

See "Equivocal or Occult Findings" in: **CH-25.5 Breast MRI Indications**.

See also: **ONC-30~Metastatic Cancer and Carcinomas of Unknown Primary Site**

Axillary Lymphadenopathy - Practice Notes

Adenocarcinoma is the most common histology, with breast cancer seen most often; non-palpable breast cancer and axillary metastases accounts for less than 0.5% of all breast cancers. Carcinomas of the lung, thyroid, stomach, colon, rectum, and pancreas have the potential to spread to axillary lymph nodes, but these metastases are rarely the first manifestations of disease.

CH-2.3 Mediastinal Lymphadenopathy

- ✓ Chest CT with contrast (CPT® 71260) can be performed if mediastinal abnormalities are detected on a chest x-ray (overread by a radiologist) or other non-dedicated advanced chest imaging.
- ✓ Follow-up chest CT (CPT® 71260) can be performed at 4 weeks[4] if:
  - Enlarged lymph nodes are in the mediastinum with no other thoracic abnormalities; ***and***
  - Low risk or no clinical suspicion for malignancy
  - Thereafter, stability does not require further advanced imaging
- ✓ Further evaluations
  - Lymph node biopsy (see methods below) should be considered for:
    - Persistent lymphadenopathy on follow-up chest CT; or
    - Suspected malignancy

Practice Notes

Lymphadenopathy from neoplasms as well as from benign sources of inflammation can result in a positive PET scan. Therefore, the use of PET may not be helpful prior to histologic diagnosis.

Less invasive methods of mediastinal biopsies are percutaneous biopsy, transbronchial biopsy, transbronchial biopsy using endobronchial ultrasound, and endoscopic ultrasound-guided FNA.

More invasive and traditional methods are mediastinoscopy or thoracoscopy/thoracotomy.

References

1. van Overhagen H, Brakel K, Heijenbrok MW, et al. Metastases in supraclavicular lymph nodes in lung cancer: assessment with palpation, US, and CT. Radiology 2004;232:75-8
2. Lehman CD, DeMartini W, Anderson BO, et al. Indications for breast MRI in the patient with newly diagnosed breast cancer. *J Natl Compr Canc Netw* 2009;7(2):193-201.
3. Yamaguchi H, Ishikawa M, Hatanaka K, et al. Occult breast cancer presenting as axillary metastases. *The Breast* 2006;15:259-262.
4. Stigt, Jos A. MD; Boers, James E. MD, PhD; Oostdijk, Ad H. MD; van den Berg, Jan-Willem K. MD, PhD; Groen, Harry J. MD, PhD. Mediastinal Incidentalomas, *Journal of Thoracic Oncology*: August 2011 – Volume 6 – Issue 8 – pp 1345-1349.
5. English BS, Ray CE Jr, Chang JY, Crabtree TD, Gaba RC, Gipson MG, Iannettoni MD, Kouri BE, Marshalleck FE, Mohammed TL, Pinchot JW, Saleh AG, Willers H, Hohenwalter EJ, Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® radiologic management of thoracicnodules and masses. Reston (VA): American College of Radiology (ACR); 2015. 14 p.

CH-3~COUGH

CH-3.1 Cough

- ✓ Initial evaluation should include a recent chest x-ray after the current episode of cough started or changed.[1]
  - Discontinue all medications known to cause coughing (e.g. ACE inhibitors).[1]
- ✓ If the initial chest x-ray is without abnormalities, a chest CT (either with contrast [CPT® 71260] or without contrast [CPT® 71250]) can be performed for the following:
  - Cough in non-smoker after the following sequence for a total 3 week trial and investigation:
    - Antihistamine and decongestant treatment[1]
    - Bronchoprovocation challenge (e.g. methacholine challenge, exhaled nitric oxide test) and spirometry should be performed to rule out asthma[1]
    - Empiric trial of corticosteroids[1]
    - Treatment of gastroesophageal reflux disease (GERD)[1]
    - See: **HD-29~Sinusitis**
  - Current or past cigarette smokers with either:
    - New cough lasting greater than 2 weeks (URI based cough can be prolonged)
    - Changed chronic cough in worsening frequency or character
    - See: **CH-6~Hemoptysis**
- ✓ For any abnormalities present on the initial chest x-ray, advanced chest imaging can be performed according to the relevant Chest Imaging Guidelines section[1].

Practice Notes

The resolution of cough usually will occur at a median time of 26 days of stopping use of the angiotensin-converting enzyme (ACE) inhibitor drug.[1] Smoking cessation is "almost always effective" in resolving cough in smoker[1].

It should be realized that cough after URI (Upper Respiratory Infection) can typically last beyond 2-3 weeks[2].

References

1. Pratter, M, et. al., An Empiric Integrative Approach to the Management of Cough: ACCP Evidence-Based Clinical Practice Guidelines. *Chest.* 2006;129(1_suppl):222S-231S. doi:10.1378/chest.129.1_suppl.222S
2. Ebell MH, Lundgren J, Youngpairoi S, (2013). How long does a cough last? Comparing patients' expectations with data from a systematic review of the literature. *Ann Fam Med*, 11, 15-13.

CH-4~NON-CARDIAC CHEST PAIN

See also the following guidelines:

- **CH-27~Pulmonary Embolism**
- **CH-30.1 Aortic Dissection**
- **CD-1 General Guidelines**
- **CD-8 CT Heart and Coronary Computed Tomography Angiography (CCTA)**

✓ "Evidence is not conclusive whether Triple-rule-out CT (CAD, PE, and AD) will improve efficiency of patient management" with acute chest pain.

✓ MRI is not supported in the evaluation of chest pain.

CH-4.1 Non-Cardiac Chest Pain - Imaging

✓ Initial evaluation should include a chest x-ray[1, 2].

✓ If x-ray is abnormal, chest CT with contrast (CPT® 71260) or CTA chest with contrast (CPT® 71275) can be performed[1, 2, 3, 4].

✓ If x-ray is normal, patient should undergo evaluation of other possible causes of pain prior to advanced imaging (CT chest with contrast or CTA chest with contrast) including[1, 2, 3, 4].

- Cardiac (ECG, echocardiogram, stress test)[1, 2], (see **Cardiac CCTA**) *and*
- GI (trial of anti-reflux medication, possible upper endoscopy, pH probe, esophageal manometry)[1].
- Either a barium swallow esophageal pH monitoring, manometry, or endoscopy should be done in all after cardiac causes have been ruled out since GERD in the cause in almost 60%, and
- Pulmonary (PFT's)[1, 2].

✓ Chest CT with contrast (CPT® 71260) can be performed if persistent:

- The initial chest x-ray reveals no abnormalities; and either
  - Sickle cell disease[2], or
  - Suspected lung mass in a patient with chest pain, cough, and weight loss[2].

CH-4.2 Costochondritis/Other Musculoskeletal Chest Wall Syndrome

✓ Costochondritis or other suggested musculoskeletal chest wall syndrome does not require advanced imaging (CT or MRI) unless it meets other criteria in these guidelines. Costochondritis can be readily diagnosed with palpation tenderness and/or hooking maneuver and imaging is non-specific. [3, 4]

Practice Notes

Differential diagnosis of non-cardiac nonspecific chest pain includes aortic, pulmonary, gastrointestinal (GI), or musculoskeletal pathologies. Chest x-ray could identify pneumothorax, pneumomediastinum, fractured ribs, acute and chronic infections, and malignancies.[1]

References

1. Hoffman U, Venkatesh V, White RD, Woodard PK, Carr JJ, Dorbala S, Earls JP, Jacobs JE, Mammen L, Martin ET III, Ryan T, White CS, Expert Panel on Cardiac Imaging. ACR Appropriateness Criteria® acute nonspecific chest pain - low probability of coronary artery disease. American College of Radiology (ACR);2015.
2. Woodard PK, White RD, Abbara S, Araoz PA, Cury RC, Dorbala S, Earls JP, Hoffmann U, Hsu JY, Jacobs JE, Javidan-Nejad C, Krishnamurthy R, Mammen L, Martin ET, Ryan T, Shah AB, Steiner RM, Vogel-Claussen J, White CS, Expert Panel on Cardiac Imaging. ACR Appropriateness Criteria® chronic chest pain - low to intermediate probability of coronary artery disease. American College of Radiology (ACR); 2012.
3. Proulx AM, Zryd TW. Costochondritis: diagnosis and treatment. *Am Fam Physician*. 2009 Sep 15;80(6):617.

CH-5~DYSPNEA/SHORTNESS OF BREATH

CH-5.1 Dyspnea/Shortness of Breath

Dyspnea is the subjective experience of breathing discomfort.

- ✓ Initial evaluation should include a recent chest x-ray.[1, 2] If x-ray is abnormal, chest CT without contrast (CPT® 71250) can be performed[1, 2].
- ✓ If the initial chest x-ray is indeterminate, chest CT without contrast (CPT® 71250, including HRCT), or chest CT with contrast (CPT® 71260) can be performed if the following evaluations have been conducted and are indeterminate[2]:
  - ECG, echocardiogram or stress testing[2], *and*
  - Pulse oximetry and pulmonary function studies (PFT's)[2], *and/or*
  - Blood work including CBC and thyroid function tests[2], if appropriate.

CH-5.2 Pre-Operative Assessment

- ✓ "Split Function Studies" (CPT® 78597-Quantitative Differential Pulmonary Perfusion, Including Imaging When Performed or CPT® 78598-Quantitative Differential Pulmonary Perfusion and Ventilation (e.g., Aerosol or Gas), Including Imaging When Performed) can be considered for pre-operative assessment prior to planned segmental, lobar or lung removal[3,4].

If pulmonary embolus (PE) is suspected, see **CH-27~Pulmonary Embolism**

References

1. Dyer DS, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® chronic dyspnea - suspected pulmonary origin. American College of Radiology (ACR); 2012
2. Abbara S, Ghoshhajra B, White RD, Woodard PK, Atalay MK, Haramati LB, Hendel RC, Khan AR, Martin ET III, Rozenshtein A, Steiner RM, Expert Panel on Cardiac Imaging. ACR Appropriateness Criteria® dyspnea -- suspected cardiac origin. American College of Radiology (ACR); 2010
3. Morton KA, Clark PB, et al. Diagnostic Imaging: Nuclear Medicine, Amursys, 2007; (4)2-15.
4. Thrall JH, Zeissman HA, Nuclear Medicine, The Requisites, Mosby, 2001, 145-165.

CH-6~HEMOPTYSIS

CH-6.1 Hemoptysis

- ✓ Chest CT with contrast (CPT® 71260) OR without contrast (CPT® 71250) OR CTA chest (CPT® 71275) may be performed after:
  - Abnormal chest x-ray, *or*
  - No chest x-ray needed if any of the following:
    - High risk for malignancy with >40 years of age and >30 pack-year smoking history, *or*
    - Persistent/recurrent with >40 years of age or >30 pack year smoking history, or
    - Massive hemoptysis (≥30cc per episode or unable protect airway) [1]

Reference

1. Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® hemoptysis. Reston (VA): American College of Radiology (ACR); 2014.

CH-7~BRONCHIECTASIS

CH-7.1 Bronchiectasis - Imaging

- ✓ High resolution chest CT scan (HRCT) without contrast (CPT® 71250):
  - To confirm suspected diagnosis of bronchiectasis after an initial x-ray [1, 2]; ***or***
  - For known bronchiectasis with worsening symptoms or worsening PFT's [2].
  - For hemoptysis with known or suspected bronchiectasis [3]

References

1. Schneebaum N, Blau H, Soferman R, Mussaffi H, et al. Use and yield of chest computed tomography in the diagnostic evaluation of pediatric lung disease. Pediatrics, 2009;124:472-479.
2. Rosen MJ. Chronic cough due to bronchiectasis: ACCP evidence-based clinical practice guidelines. *Chest*, 2006; 129: 122S-131S.
3. Guidelines for Non-CF Bronchiectasis, British Thoracic Society, Bronchiectasis Guideline Group, Thorax, 65, Supplement 1, July 2010.
4. Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® hemoptysis. Reston (VA): American College of Radiology (ACR); 2010.
5. Hansell DM, (1998). *Bronchiectasis.* Radiologic Clinics of North America, 36(1): 107-28.

CH-8~BRONCHITIS

CH-8.1 Bronchitis

- ✓ Advanced imaging is not needed for bronchitis [1, 2]
- ✓ Chest x-ray to determine if any abnormality is present

References

1. Braman, S. S., Chronic cough due to acute bronchitis: ACCP evidence-based clinical practice guidelines, *Chest* 2006,129, 95S-103S.
2. Michigan Quality Improvement Consortium. Management of uncomplicated acute bronchitis in adults. Southfield (MI): Michigan Quality Improvement Consortium; 2012

CH-9~ASBESTOS EXPOSURE

CH-9.1 Asbestos Exposure

- ✓ Chest x-ray as radiographic screening for asbestos exposure [1, 2].
  - Stable calcified pleural plaques on chest x-ray do not require advanced imaging of the chest.[2]
- ✓ CT of the chest should not be used to screen populations at risk for asbestos-related diseases.[2]
- ✓ High resolution chest CT (HRCT) (CPT® 71250) is considered for [2]:
  - Any change seen on chest x-ray
    - Send requests for additional follow-up imaging to Medical Director for review

Practice Notes

Asbestosis and asbestos-related diseases include: pleural effusion, pleural plaques, lung cancer, and malignant mesothelioma. The risk of developing mesothelioma increases with increasing intensity and duration of exposure.

Reference

1. OSHA, Occupational Safety and Health Standards, Medical surveillance guidelines for asbestos, 1910.1001 App H.
2. Daniel E. Banks, et. al., American College of Chest Physicians Consensus Statement on the Respiratory Health Effects of Asbestos: Results of a Delphi Study, Chest. 2009;135(6):1619-1627. doi:10.1378/chest.08-1345. http://www.atsdr.cdc.gov/asbestos/site-kit/docs/clinscrguide_32205_lo.pdf

CH-10~Chronic Obstructive Pulmonary Disease (COPD)

CH-10.1 COPD - Imaging

- ✓ Chest x-ray should be performed initially
- ✓ Chest CT without contrast (CPT® 71250) or Chest CT with contrast (CPT® 71260)[1, 2, 3, 4] can be performed if emphysema is suspected and either:
  - Pre-operative study for Lung Volume Reduction Surgery (LVRS) [1,]
  - Definitive diagnosis is not yet determined by laboratory studies and chest x-ray and one on the following is suspected bronchiectasis, sarcoidosis, emphysema, pneumoconiosis, idiopathic pulmonary fibrosis, Langerhans cell histiocytosis, hypersensitivity pneumonitis, bronchiolitis obliterans, lipoid pneumonia, drug toxicity, and lymphangitic cancer[2]
- ✓ Lung cancer screening is discussed in the following guideline:
  - See "Screening Indications" in **ONC-8~Non-Small Cell Lung Cancer**

Practice Notes

COPD includes asthmatic bronchitis, chronic bronchitis, and emphysema. COPD is airflow reduction (FEV1/FVC ratio < 0.7 or FEV1 ≥ 80% predicted) in the presence of respiratory symptoms, such as dyspnea. Advanced chest imaging is not typically indicated in COPD exacerbation, which is an acute change in baseline dyspnea, cough, and/or sputum beyond normal day-to-day variations.[2, 3]

Reference

1. Dyer DS, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® chronic dyspnea - suspected pulmonary origin. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 5 p. Austin JHM. Pulmonary emphysema: Imaging assessment of lung volume reduction surgery. *Radiology* 1999;212:1-3.

CH-11~INTERSTITIAL DISEASE

CH-11.1 Interstitial Disease

- ✓ High resolution chest CT (HRCT) without contrast (CPT® 71250) is the diagnostic modality of choice to evaluate for:
  - Interstitial changes identified on other imaging (including chest x-ray) in patients with pulmonary symptoms and abnormal pulmonary function studies (PFT'S) (see: **CH-5~Dyspnea**)
  - Initial request to identify interstitial disease with a connective tissue disease diagnosis, including rheumatoid arthritis, scleroderma and the myopathies as well as in occupational lung disease such as asbestosis, silicosis and coal miner's lung disease
  - New or worsening pulmonary symptoms or worsening PFT's in any type of interstitial disease, including connective tissue diseases, or
  - Once a year in patients with known idiopathic pulmonary fibrosis (IPF) if showing progression or regression of disease will change patient management

Reference

1. Dyer DS, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® chronic dyspnea - suspected pulmonary origin. [online publication]. Reston (VA): American College of Radiology (ACR); 2012.
2. Misumi S and Lynch DA. Idiopathic pulmonary fibrosis/Usual interstitial pneumonia. Imaging diagnosis, spectrum of abnormalities, and temporal progression. *Proceedings of the American Thoracic Society* 2006;3:307-314.
3. Wells AU, Hirani N, et al. Interstitial lung disease guideline: the British Thoracic Society in collaboration with the Thoracic Society of Australia and New Zealand and the Irish Thoracic Society. Thorax, 2008;63(Suppl V):v1-v58.
4. Dempsey OJ, Kerr KM, Remmen H, Denison AR. How to investigate a patient with suspected interstitial lung disease. BMJ, 2010;340:1294-1299.
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CH-12~MULTIPLE PULMONARY NODULES

CH-12.1 Multiple Pulmonary Nodules

- ✓ The largest of multiple pulmonary nodules should be imaged based on guideline: See **CH-16~Solitary Pulmonary Nodule (SPN)**
- ✓ Suspected infection with multiple pulmonary nodules can be followed with chest CT without contrast (CPT® 71250) **or** chest CT with contrast (CPT® 71260). Follow-up imaging should not exceed 3 studies in 3 months.

Practice Notes

More than 6 nodules and clustering of multiple nodules in a single location usually indicate inflammatory lung disease although a dominant nodule with adjacent small satellite nodules can be seen in primary lung cancer.

References

1. Libby DM, Smith JP, Altorki NK, et al. Managing the small pulmonary nodule discovered by CT. *Chest* 2004 April;125(4):1522-1529.
2. MacMahon H, Austin JHM, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. *Radiology* 2005; 237:395-400.
3. DP, Bankier AA, MacMahon H, et al. "Differential diagnosis and evaluation of multiple pulmonary nodules" (2013) Naidich Recommendations for the management of subsolid pulmonary nodules detected at CT: a statement from the Fleischner Society. *Radiology* 2013; 266:304.

CH-13~PNEUMONIA

CH-13.1 Pneumonia

- ✓ Chest x-ray would be performed initially in all patients with suspected pneumonia, prior to considering advanced imaging. [1, 2]
- ✓ Chest CT with contrast (CPT® 71260) if initial or repeat chest x-ray findings reveal:
  - Complication of pneumonia (e.g. abscess, effusion, hypoxemia, respiratory distress, necrotizing pneumonia, pneumothorax), [1, 2]
  - Possible lung mass associated with the infiltrate, [2]

References

1. Mandell LA, Wunderink RG, Anzueto A, Bartlett JG, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis*. 2007 Mar 1;44 Suppl 2:S27-72.
2. Bradley JS, The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis. 2011 Oct;53(7):e25-76
3. Kirsch J, Ramirez J, Mohammed TH, Amorosa JK et al. ACR Appropriateness Criteria: acute respiratory illness in immunocompetent patients. Last reviewed 2011.

CH-14~Other Chest Infections

CH-14.1 PPD or TB

- ✓ Chest CT with contrast (CPT® 71260) is appropriate for individuals with:
  - Positive PPD skin test or other positive tuberculin skin tests and normal chest x-ray who have not had a previous normal chest CT, or
  - Suspected complications or progression of tuberculosis (e.g. pleural tuberculosis, empyema, mediastinitis).
- ✓ If chest CT is unremarkable, there is insufficient data to support performing subsequent chest CT unless symptoms develop or chest x-ray shows a new abnormality.
- ✓ Follow-up chest CT with contrast (CPT® 71260) with frequency at the discretion of the pulmonary specialist (not to exceed 3 studies in 3 months)
  - Re-evaluate individuals undergoing active treatment for tuberculosis who had abnormalities seen only on chest CT.

CH-14.2 Suspected Sternal Dehiscence

- ✓ Sternal wound dehiscence is primarily a clinical determinations.
- ✓ Chest x-ray is performed prior to advanced imaging to identify abnormalities in the sternal wire integrity and/or a midsternal stripe. Other findings include rotated, shifted or ruptured wires.
- ✓ CT chest without contrast can be considered if there is planned debridement and/or repair.

Practice Notes

Chest CT can show evidence of tuberculosis (e.g. primary complexes, mediastinal or hilar lymphadenopathy) in up to 20% of patients with unremarkable chest x-rays.

References

1. Kim WS, Moon WK, Kim IO, et al. Pulmonary tuberculosis in children: evaluation with CT. *AJR* 1997 April; 168(4):1005-1009.
2. Uzum K, Karahan OI, Dogan S, et al. Chest radiography and thoracic computed tomography findings in children who have family members with active pulmonary tuberculosis. *Eur J Radiol* 2003 Dec;48(3):258-262.
3. Thorac Cardiovasc Surg. 2006 Mar;54(2):108-11. Early detection of sternal dehiscence by conventional chest X-ray. Peivandi AA1, Vogel N, Opfermann UT, Singelmann J, Kuroczynski W, Kreitner KF, Dahm M, Vahl CF.
4. Thorac Cardiovasc Surg. 2006 Mar;54(2):108-11. Early detection of sternal dehiscence by conventional chest X-ray. Peivandi AA1, Vogel N, Opfermann UT, Singelmann J, Kuroczynski W, Kreitner KF, Dahm M, Vahl CF.

CH-15~SARCOID

CH-15.1 Sarcoid

- ✓ Chest CT either with contrast (CPT® 71260) or without contrast (CPT® 71250) is appropriate for the following:
  - Establish or rule out the diagnosis when suspected,
  - Development of worsening symptoms,
  - New symptoms appear after a period of being asymptomatic, or
  - Treatment change is being considered in known sarcoid
- ✓ If CT is equivocal, definitive diagnosis can only be made by biopsy.
  - Requests for PET to confirm diagnosis of sarcoid should be sent for Medical Director review.
- ✓ Gallium scan can be considered as an alternative or supplemental to CT chest with:
  - Suspected sarcoid
  - Suspected inflammatory reaction
- ✓ There is currently no evidence-based data to support performing serial PET scans to monitor disease activity while tapering steroid therapy.

For Cardiac PET (CPT® 78459), See **CD-7~CARDIAC PET**

See also: **HD-22~Cerebral Vasculitis** in the Head Imaging Guidelines

References

1. Hantous-Zannad S, Charrada L, Zidi A, et al. Value of CT scanning in the investigation of thoracic sarcoidosis. *Rev Mal Respir* 2003 April;20(2 pt 1):207-213.
2. Okumura W, Iwasaki T, Toyama T, et al. Usefulness of fasting ^{18}F-FDG PET in identification of cardiac sarcoidosis. *J Nucl Med* 2004;45(12):1989-1998.

CH-16~Solitary Pulmonary Nodule (SPN)

CH-16.1 SPN - Imaging

- ✓ Chest CT with contrast (CPT® 71260) or chest CT without contrast (CPT® 71250) (with contrast is preferred for initial evaluation) can be performed for discrete nodule(s) in the following scenarios:
  - Lung nodule(s) seen on an imaging study other than a "dedicated" chest CT or MR (chest x-ray, abdominal CT, spine MRI, coronary artery CTA, etc.). Examples of other studies: chest x-ray, abdominal CT, spine MRI, coronary CTA (see: **CH-1.3 General Guidelines - Chest CT**).
  - Lung nodule(s) identified incidentally on any of the following dedicated chest studies can replace Chest CT with contrast (CPT® 71260) or Chest CT without contrast (CPT® 71250) as the initial dedicated study: (See: **CH-1.3**)
    - Chest CT without and with contrast (CPT® 71270)
    - Chest CTA without and with contrast (CPT® 71275)
    - Chest MRI without contrast (CPT® 71550)
    - Chest MRI without and with contrast (CPT® 71552)
    - Chest MRA without and with contrast (CPT® 71555)
  - Low Dose CT Chest (HCPCS G0297) can be used instead of CT Chest (CPT® 71250, CPT® 71260) for follow-up of lung nodule(s) identified on Lung Cancer Screening,
  - After preliminary comparison with any available previous chest films to determine if nodule was present and stable
  - Using largest measurement of multiple lung nodule
  - See: **CH-12~Multiple Pulmonary Nodules**
  - Similar-sized pleural nodule is treated as a pulmonary nodule, except does not require PET scan (see: **CH-12~Multiple Pulmonary Nodules**).
  - Following the **Fleischner Society Guidelines** for high risk* below:

NODULE SIZE (mm)	**CHEST CT INTERVAL** (months)
<4	Follow-up at 12; if unchanged, no further follow-up
4, but < 6	Follow-up at 6-12; then at 18-24 (complete to 24)
>/= 6, but < 8	Follow-up at 3-6; then 9-12; then 24
>/= 8	Follow-up at 3, 9 and 24, consider PET or biopsy
After 3-6 month LDCT for new nodule	Continue annual screening with LDCT in 12 months
**High risk is applied to all individuals since the Fleischner Society has not defined these factors (which may be considered smoking history, age, family history, cancer history or previous radiation therapy).*	

- No further advanced imaging is necessary if a nodule has been stable for 2 years, and may be shorter or not needed if:
  - Nodule stable on chest x-ray for at least 2 years
  - Decreasing or disappearing nodule(s)
  - Stable nodule(s) >4mm
  - </= 4mm nodule(s) only requires 12 months
  - At any time, if:
    - Classically benign characteristics by chest x-ray or previous CT (e.g. benign calcification pattern typical for a granuloma or hamartoma)
    - Decreasing or disappearing nodule(s)
  - Except ground glass or sub-solid densities, which can be imaged beyond 2 years

SPECIAL SITUATIONS Chest CT imaging interval:

CLINICAL FINDINGS	CHEST CT INTERVAL (months)
Negative PET	3 (after PET), 9, and 24
Previous or current malignancy and pulmonary nodule(s)that would reasonably metastasize to the lungs	3, 6, 12, and 24
Ground Glass or Subsolid Nodules	3, then every 6 months and beyond 2 years

✓ PET (CPT® 78812 or CPT® 78815) is appropriate for a distinct lung nodule ≥8 mm on chest CT(A) or MR(A).
- If there is a history of malignancy, refer to the appropriate Oncology restaging/recurrence guideline for indications for PET imaging.
- Not pleural nodule, infiltrate, ground glass opacity, or hilar enlargement.
- Serial PET studies are not considered appropriate.

Practice Notes

A **nodule** is any pulmonary or pleural lesion that is a discrete, spherical opacity 2-30 mm in diameter surrounded by normal lung tissue. A larger nodule is called a mass. Entities that are not nodules, and are considered benign, include non-spherical linear, sheet-like, two-dimensional or scarring opacities.

Malignant nodule features can include spiculation, abnormal calcification, size greater than 7-10 mm, ground glass opacity, interval growth, history of a cancer that tends to metastasize to the lung or mediastinum, and/or smoking history.

- A nodule that grows at a rate consistent with cancer (doubling time 30 to 360 days) may be sampled for biopsy or resected.
- Less than 1% of <7mm nodules are malignant.
- A nodule that does not grow in 6 months has a risk of malignancy at <10%.

Benign features can include benign calcification (80% granuloma, 10% hamartoma), multiple areas of calcification, small size, multiple nodules, negative PET, and stability of size over 2 years.

Ground glass or subsolid opacities, which can harbor indolent adenocarcinoma, may require longer follow-up time than 2 years and may be resected if greater than 2 cm or if are more dominantly nodular (part-solid or solid). According to the Fleischner Society (2013), focal nodular areas of increased lung attenuation mostly identified on CT scan, which have typically been separated as either "pure" or "part-solid" ground glass", should better be unified as "subsolid nodules."

Repeat PET is discouraged, since if the original PET is positive, biopsy may be performed. If the original PET is negative but subsequent chest CT shows increase in size of the nodule, biopsy may be performed.

False positive PET can occur with infection or inflammation; false negatives can occur with small size nodule, ground glass lesions and indolent cancers such as bronchoalvealor or carcinoid.

References

1. *ACR Appropriateness Criteria, Solitary pulmonary nodule,* 2008.
2. Benjamin MS, Drucker EA, McLoud TC, Shepard JAO. Small pulmonary nodules: detection at chest CT and outcome. *Radiology* 2003;226:489-493.
3. Fletcher JW, Kymes SM, Gould M, et al. A comparison of the diagnostic accuracy of ^{18}F-FDG PET and CT in the characterization of solitary pulmonary nodules. *J Nucl Med* 2008;49:179-185.
4. Henschke CI, McCauley DI, Yankelevitz DF, et al. Early Lung Cancer Action Project: overall design and findings from baseline screening. *Lancet* 1999 July;354(9173):99-105.
5. Henschke CI, Yankelevitz DF, Mirtcheva R, et al. CT screening for lung cancer: frequency and significance of part-solid and nonsolid nodules. *AJR* 2002 May:178(5):1053-1057.
6. Henschke CI, Yankelevitz DF, Naidich DP, et al. CT screening for lung cancer: suspiciousness of nodules according to size on baseline scans. *Radiology* 2004;231:164-168.
7. Libby DM, Smith JP, Altorki NK, et al. Managing the small pulmonary nodule discovered by CT. *Chest* 2004 April;125(4):1522-1529.
8. Lindell RM, Hartman TE, Swensen SJ, et al. Lung cancer screening experience: a retrospective review of PET in 22 non-small cell lung carcinomas detected on screening chest CT in a high-risk population. *AJR* 2005;185:126-131.
9. MacMahon H, Austin JHM, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. *Radiology* 2005;237:395-400.
10. McCarville MB, Lederman HM, Santana VM. Distinguishing benign from malignant pulmonary nodules with helical chest CT in children with malignant solid tumors. *Radiology* 2006 May;239(2):514-520.
11. Michael K. Gould, MD, FCCP; James Fletcher, MD; Mark D. Iannettoni, MD, FCCP; William R. Lynch, MD; David E. Midthun, MD, FCCP; David P. Naidich, MD, FCCP; David E. Ost, MD,

FCCP, Evaluation of Patients With Pulmonary Nodules: When Is It Lung Cancer? ACCP Evidence-Based Clinical Practice Guidelines (2nd Edition), Chest, September 2007, Vol 132, No. 3_suppl.
12. Naidich et al, Recommendations for the Management of Subsolid Pulmonary Nodules Detected at CT: A Statement from the Fleischner Society, Radiology: Volume 266: Number 1—January 2013
13. Swensen SJ, Jett JR, Hartman TE, et al. CT screening for lung cancer: five-year prospective experience. *Radiology* 2005;235:259-265.
14. Winer-Muram HT. The solitary pulmonary nodule. *Radiology* 2006 April;239(1):34-49.

CH-17~Pleural-Based Nodules and Other Abnormalities

CH-17.1 Pleural-Based Nodules and Other Abnormalities

- ✓ Chest CT with contrast (CPT® 71260) or chest CT without contrast (CPT® 71250) (with contrast is preferred for initial evaluation) can be performed for pleural nodule(s) [1, 2]:
  - Pleural nodule(s) seen on an imaging study other than a "dedicated" chest CT or MR[1, 2] (see: **CH-1.3)**.
  - Pleural nodule(s) identified incidentally on any of the following dedicated chest studies can replace Chest CT as the initial dedicated study[1, 2] (see: **CH-1.3**).
  - After preliminary comparison with any available previous chest films to determine **presence** and stability.
  - Using largest measurement of multiple nodule(s)[1] (see: **CH-12~Multiple Pulmonary Nodules**).
  - Following the Fleischner Society Guidelines for high risk (See **CH-16.1**)[1].
- ✓ PET can be considered if dedicated CT or MRI Chest identifies a pleural nodule/mass or defined area of pleural thickening that is >8 mm when there is a likelihood of malignancy including current or previous malignancy, pleural effusion, bone erosion, chest pain.[2]

Practice Notes

Pleural nodule/mass or thickening without suggestion of malignancy would undergo surveillance or biopsy.[2]

Reference

1. MacMahon H, Austin JHM, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. *Radiology* 2005;237:395-400.
2. Rivera MP, et. al., Establishing the diagnosis of lung cancer: diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest*. 2013 May;143(5 Suppl):e142S-65S

CH-18~Pleural Effusion

CH-18.1 Pleural Effusion

- ✓ Chest CT with contrast (CPT® 71260) can be performed after both:
  - Chest x-ray including lateral decubitus films; ***and***
  - Thoracentesis to determine if fluid is exudative and remove as much as possible (fluid obscures underlying lung parenchyma and mass).
- ✓ Chest ultrasound (CPT® 76604) can be used as an alternative to chest x-ray to evaluate for the presence of fluid within the pleural spaces.

Practice Notes

Bilateral effusions are more often systemic related transudates (CHF, RF, liver insufficiency, etc.), and advanced imaging is rarely needed. Large unilateral effusions can be malignant. Analysis of fluid may include: cytology, culture, cell count, and biochemical studies.

References

1. Light RW, MacGregor MI, Luchsinger PC, et al. *Pleural effusions: the diagnostic separation of transudates and exudates. Ann Intern Med* 1972;77:507-13.
2. British Thoracic Society Pleural Disease Guideline 2010: BTS Guidelines for the Management of Pleural Disease. Thorax 2010; 65; Suppl II.

CH-19~PNEUMOTHORAX/HEMOTHORAX

CH-19.1 Pneumothorax/Hemothorax

- ✓ Chest x-ray should be performed initially.
- ✓ Chest CT with contrast (CPT® 71260) or without contrast (CPT® 71250) if:
  - Diagnosis of a small pneumothorax is in doubt, and the presence of a pneumothorax will affect patient treatment decisions.
  - Preoperative study for treatment of pneumothorax
    - Pneumothorax associated with hemothorax
    - Suspected complications from hemothorax (e.g. empyema)

Practice Notes

Expiration chest x-ray can enhance evaluation of equivocal plain x-ray. There is no data supporting the use of serial chest CT to follow patients with known pneumothorax or hemothorax who are asymptomatic or have stable symptoms. With the exception of the indications above, advanced imaging of the chest is rarely indicated in the diagnosis or management of pneumothorax. Inspiratory/expiratory chest x-rays are helpful in defining whether a pneumothorax is present.

References

1. Manes, N., et al. (2002). "Pneumothorax--guidelines of action." *Chest* 121(2): 669.
2. Mowery, N. T., et al. (2011). "Practice management guidelines for management of hemothorax and occult pneumothorax." *J Trauma* 70(2): 510-518.

CH-20~Mediastinal Lymphadenopathy

See: **CH-2.3 Mediastinal Lymphadenopathy**

CH-21~MEDIASTINAL MASS

CH-21.1 Mediastinal Mass

- ✓ Chest CT with contrast (CPT® 71260) is the imaging study of choice to evaluate mediastinal abnormalities on chest x-ray and can be done once initially if there is a concern for:
  - Mediastinal cyst including bronchogenic, thymic, pericardial or esophageal
    - Subsequent evaluations either with CT Chest or MRI Chest can be performed if:
      - New signs or symptoms, or
      - Preoperative
- ✓ For Adenopathy; see **CH-2**
- ✓ For Goiter; see **NECK-9**

References

1. Kuhlman JE, Bouchardy L, Fishman EK, Zerhouni EA. CT and MR imaging evaluation of chest wall disorders. *RadioGraphics* 1994 May;14(3):571-595.
2. Juanpere S, Canete N, Ortuno P, Martinez S. A diagnostic approach to the mediastinal masses. Insights Imaging, 2013; 4:29-52.
3. Pericardial Cyst, Christopher Komanapalli, Paul Schipper, Mithran Sukumar; http://www.ctsnet.org/article/pericardial-cyst; acvquired May 5,2016.

CH-22~CHEST TRAUMA

CH-22.1 Chest Trauma

- ✓ Chest X-ray should be performed initially.
- ✓ Chest CT without contrast (CPT® 71250) or with contrast (CPT® 71260) is appropriate for the following situations[1]:
- ✓ Rib[1] or Sternal[2] Fracture:
  - With associated complications identified clinical or by other imaging, including pneumothorax, hemothorax, pulmonary contusion, atelectasis, flail chest, cardiovascular injury and/or injuries to solid of hollow abdominal organs. [1]
  - Single fractures, multiple fractures, non-acute fractures, or occult rib fractures are NOT an indication for chest CT unless malignancy is suspected in the etiology. [1]
- ✓ Routine follow-up advanced imaging of rib or sternal fractures is not indicated. [1]
- ✓ No advanced imaging of the abdomen or pelvis is indicated when there is chest trauma and no physical examination or laboratory evidence of injury.

References

1. Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Dyer DS, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® rib fractures. American College of Radiology (ACR); 2011
2. Clancy K, Velopulos C, Bilaniuk JW, Collier B, Crowley W, Kurek S, Lui F, Nayduch D, Sangosanya A, Tucker B, Haut ER, Eastern Association for the Surgery of Trauma.
3. Screening for blunt cardiac injury: an Eastern Association for the Surgery of Trauma practice management guideline. *J Trauma Acute Care Surg*. 2012 Nov;73(5 Suppl 4):S301-6

CH-23~CHEST WALL MASS

CH-23.1 Chest Wall Mass

- ✓ Chest x-ray or chest ultrasound (CPT® 76604) should be performed initially in all cases of chest wall mass.
- ✓ Chest CT with contrast (CPT® 71260) or chest CT without contrast (CPT® 71250) or MRI chest without and with contrast (CPT® 71552) can be considered when the following are met:
  - Chest x-ray completed and does not demonstrate any of the following:
    - Obvious lipoma
    - Clearly benign entity
    - No mass identified (radiographically or palpated)

Practice Notes

Chest x-rays of chest wall masses can detect calcification, ossification, or bone destruction as well as location and size.[3]

References

1. Tateishi, U, et al., Chest Wall Tumors: Radiologic Findings and Pathologic Correlation, malignant Tumors, RadioGraphics, November 2003, 23(6).
2. Nam SJ, et al., Imaging of Primary Chest Wall Tumors with Radiologic-Pathologic Correlation. RadioGraphics, May-June 2011, 31 (3)
3. David EA and Marshall MB, Review of Chest Wall Tumors: A Diagnostic, Therapeutic, and Reconstructive Challenge, Semin Plast Surg. Feb 2011; 25(1): 16–24.

CH-24~Pectus Excavatum and Pectus Carinatum

CH-24.1 Pectus Excavatum and Carinatum

- ✓ Chest CT without contrast (CPT® 71250) **or** MRI chest without and with contrast (CPT® 71552) and 3-D reconstruction (CPT® 76377) if requested can be considered if:
  - Candidates for surgical correction [1, 2]
    - Cosmetic repairs requests without physiological disability or severe deformities may not meet certain payers policies
  - Cardiac or pulmonary dysfunction has been identified [1, 2]
- ✓ ECG and echocardiography if cardiac symptoms or evidence of abnormalities of cardiac function.
- ✓ Chest x-ray and PFT's if increasing shortness of breath. [1]

See also **PACCH-11~Pectus Deformities** in the Pediatric Chest Imaging Guidelines

Reference

1. Marcovici PA, LoSasso BE, Kruk P, Dwek J. MRI for the evaluation of pectus excavatum. Pediatr Radiol, 2011; 41:757-758.
2. Goretsky MJ, Kelly RE Jr, Croitoru D, Nuss D. Chest wall anomalies: pectus excavatum and pectus carinatum. *Adolesc Med Clin*. 2004 Oct;15(3):455-71.

CH-25~BREAST ABNORMALITIES

BI-RADS™ Categories Chart

Category 0: Incomplete

Need additional imaging evaluation or prior mammograms for comparison.

Category 1: Negative

There is nothing to comment on. The breasts are symmetrical and no masses, architectural disturbances or suspicious calcifications are present.

Category 2: Benign Finding

This is also a negative mammogram, but the interpreter may wish to describe a finding. Involuting, calcified fibroadenomas, multiple secretory calcifications, fat containing lesions such as oil cysts, lipomas, galactoceles, and mixed density hamartomas all have characteristic appearances, and may be labeled with confidence. The interpreter might wish to describe intramammary lymph nodes, implants, etc. while still concluding that there is no mammographic evidence of malignancy.

Category 3: Probably Benign Finding – Short Interval Follow-up Suggested

A finding placed in this category should have a very high probability of being benign. It is not expected to change over the follow-up interval, but the radiologist would prefer to establish its stability. Data is becoming available that sheds light on the efficacy of short interval follow-up. At the present time, most approaches are intuitive. These will likely undergo future modification as more data accrue as to the validity of an approach, the interval required, and the type of findings that should be followed.

Category 4: Suspicious Abnormality – Biopsy Should Be Considered

There are lesions that do not have the characteristic morphologies of breast cancer but have a definite probability of being malignant. The radiologist has sufficient concern to urge a biopsy. If possible, the relevant possibilities should be cited so that the patient and her physician can make the decision on the ultimate course of action.

Category 5: Highly Suggestive of Malignancy-Appropriate Action Should Be Taken

These lesions have a high probability of being cancer and should be biopsied or treated surgically

Category 6: Known Biopsy-Proven Malignancy – Appropriate Action Should Be Taken

These lesions have been biopsied and are known to be malignant.

CH-25~BREAST ABNORMALITIES

*See **BI-RADS™ Categories Chart** for full description of **BI-RADS™** categories.*

CH-25.1 Breast Ultrasound

- ✓ Routine performance of breast ultrasound as stand-alone screening or with screening mammography is inappropriate.
  - Do NOT use breast ultrasound to screen general population as either a stand-alone study or a combined study with screening mammography.
- ✓ Breast ultrasound (CPT® 76641: unilateral, complete OR CPT® 76642: unilateral, limited) can be used to further evaluate abnormalities found on mammogram, especially in differentiating cysts from solid lesions.
  - Bilateral should be coded CPT® 76641 x 2 **or** CPT® 76642 x 2
- ✓ Palpable breast masses should be evaluated with mammography and breast ultrasound, in any order, regardless of age. Ultrasound can enhance biopsy.
- ✓ Axilla ultrasound (CPT® 76882)
  - For women with clinically suspicious lymph nodes, preoperative axillary ultrasound with a FNA or biopsy can help identify patients who have positive nodes.
  - Bilateral should be coded CPT® 76882 x 2

Reference

1. Mainiero MB, Lourenco A, Mahoney MC, et al. ACR appropriateness criteria breast cancer screening. J Am Coll Radiol, 2013; 10:11-14.

CH-25.2 Breast MRI

- ✓ Breast MRI is usually bilateral (CPT® 77059) or can be unilateral (CPT® 77058) in some after mastectomy, per physician request.
- ✓ MRI guided breast biopsy (CPT® 19085) includes the imaging component. Additional lesions should be billed using CPT® 19086.
- ✓ MRI Breast can be repeated at least 6 months after an MRI directed breast biopsy to document successful lesion sampling if histology is benign and nonspecific, equivocal or uncertain.

Breast MRI - Practice Notes

Although breast MRI has superior sensitivity in identifying new unknown malignancies, it carries a significant false positive risk when compared to mammogram and ultrasound. Incidental lesions are seen on 15% of breast MRI's and increase with younger age The percentage of incidental lesions that turn out to be malignant varies from 3% to 20% depending on the patient population. Cancer is identified by breast MRI in only 0.7% of those with "inconclusive mammographic lesions."[1]

CH-25.3 Breast Reconstruction

- ✓ CTA or MRA of the body part from which the free tissue transfer flap is being taken, can be performed for breast reconstruction preoperative planning.[2 3]
  - For example, CTA (CPT® 74175 and CPT® 72191) or MRA (CPT® 74185 and CPT® 72198) of the abdomen and pelvis for Deep Inferior Epigastric Perforators (DIEP) flap.
- ✓ There is currently insufficient evidence-based data to support the need for routine advanced imaging for TRAM flaps or other flaps performed on a vascular pedicle.

CH-25.4 CAD for Breast MRI

- ✓ The use of CAD with breast MRI is currently considered investigational, experimental, and/or unproven.
  - 3D rendering codes (CPT® 76376 or CPT® 76377) should not be used in conjunction with code CPT® 0159T.

See: **Preface-4.1 3D Rendering**

CH-25.5 Breast MRI is NOT Indicated

- ✓ Breast MRI should not be used to determine biopsy recommendations for suspicious or indeterminate lesion(s) that can be readily biopsied, either using imaging guidance or physical exam, such as palpable masses and microcalcifications.
- ✓ MRI should not be used for routine surveillance in patients with history of breast cancer, unless there are physical exam, imaging findings, recurrent, or residual disease at the mastectomy site
  - Annual screening breast MRI study is indicated for high risk patients as outlined in **CH-25.6 Breast MRI Indications**

- ✓ Patients with dense breasts as determined by mammogram
  - To date, evidence does not suggest improved outcomes for women whose only risk factor is breast density[9] [see heading "Equivocal or Occult Findings" (Radiologist Report) in **CH-25.6 Breast MRI Indications**].

- ✓ Low risk, probably benign (BI-RADS™ 3) lesions
  - Repeat the original type study (mammogram, US or MRI) in 6 months, thereafter screening or surveillance does not require MRI.

- ✓ Suspicious (BI-RADS™ 4 or 5) lesion on mammogram and/or ultrasound
  - Bilateral total breast ultrasound (CPT® 76641: unilateral, complete), and bilateral axillary ultrasound (CPT® 76882) are recommended for patients who have **BI-RADS™** 4 or 5 abnormalities. If additional suspicious breast lesions or more extensive malignant breast disease is detected by ultrasound, the extent of disease can be mapped with ultrasound-guided biopsies (CPT® 76942).
  - A lesion categorized as have **BI-RADS™ 4 or 5** should be biopsied.
  - A palpable lesion should be considered for biopsy.

CH-25.6 Breast MRI Indications

- ✓ Breast MRI is indicated for breast augmentation, breast implants (saline or silicone), breast reconstruction, free injection, and capsular contracture to:
  - Evaluate or confirm breast implant rupture when mammography or ultrasound is uninterpretable[6].
    - If leakage is detected on MRI or any other modality, the implant(s) should be removed and no further surveillance MRI of the affected breast(s) is indicated.
  - Surveillance for silent/asymptomatic rupture of silicone implants is considered investigational. However, certain payers may cover this surveillance.
  - Certain payers do not include breast implants in their coverage policies if the breast implants were placed as part of purely cosmetic surgery. Thus, surveillance MRI in these patients would also not be included in the coverage policy. Their coverage policies will take precedence over eviCore' guidelines.

- ✓ Annual breast MRI is indicated for high risk histologies or characteristics:
  - Atypical ductal hyperplasia (ADH); Atypical lobular hyperplasia (ALH); Lobular carcinoma in situ (LCIS)

- ✓ Equivocal or Occult Findings
  - Radiologist Report Recommendation for Breast MRI and one of the following:
    - Inconclusive or conflicting findings on mammography or ultrasound of a lesion that is not a palpable mass

- Extremely dense breasts with **BIRADS 0-3**

  - A probably benign lesion on MRI (MRI **BI-RADS™ 3**) should undergo repeat MRI in 6 months.

✓ State Specific Breast Density Laws, after screening mammography and report identifies (BIRADS 1-3):

  - New Jersey*
    - Extremely dense breasts; or
    - Any density with an abnormal mammogram; or
    - The patient has additional risk factors for breast cancer
      - The bill provides that the additional risk factors include, but are not limited to, family history of breast cancer, prior personal history of breast cancer, positive genetic testing, extremely dense breast tissue, or other indications** as determined by the patient's health care provider.

*** If multiple additional studies are recommended, there should be a logical progression of diagnostic procedures. For example, if additional mammographic images, digital breast tomosynthesis (DBT), and/or ultrasound as well as MRI are recommended, the results of the additional mammographic images, DBT and/or ultrasound studies should be obtained before an MRI is performed.**

****If the additional risk factors do not correspond to one of those traditionally associated with high risk for breast cancer, the request should be evaluated by a medical director for validity.**

✓ Newly Diagnosed Breast Cancer[4] (including DCIS)

✓ Newly Diagnosed Paget's Disease[5] (thereafter treat as DCIS according to these guidelines)

✓ Residual or Recurrent Malignancy

  - Assessment of residual tumor in patients who have undergone lumpectomy and have close or positive margins, when the findings may indicate a significant change in surgical management.
  - Evaluate clinical suspicion of recurrence, following evaluations with mammography and/or ultrasound, if those evaluations are inconclusive or conflict with physical examination or other clinical indicators. This applies to intact breasts, reconstructed breasts, and possible chest wall recurrences following mastectomy.

High Risk Indications	
For 1 and 2 below, begin MRI screening at age 25	
1.	BRCA 1 or BRCA 2 mutation [1,3]
2.	Presence of Cowden, Bannayan-Riley-Ruvalcaba[7,3] Genetic factors also associated with > 20% risk of breast cancer, include ATM, CDH1, CHEK2, PALB2, PTEN, STK11
For 3 through 9 below, MRI screening begins at age 40, or 10 years before the age of relative when first diagnosed with breast cancer, whichever is earlier. The screening MRI not to begin prior to the age of 25.	
3.	First degree relative (parent, sibling, child) with BRCA 1 or BRCA 2, even if patient has not been tested for BRCA mutation [1,3]
4.	Two or more first degree relatives with breast or ovarian cancer [2,3]
5.	One first degree relative with breast cancer or ovarian cancer that was diagnosed <age 50 [2,3]
6.	One first degree relative with bilateral breast cancer, or both breast and ovarian cancer [2,3]
7.	A first or second degree male relative (father, brother, uncle) diagnosed with breast cancer [2,3]
8	Clinical lifetime risk estimated at greater than or equal to 20% using genetic risk or clinical risk estimator such as the Gail, Claus, Tyrer-Cuzick or BRCAPRO models [1]
9	Ashkenazi Jewish women from families with onset of breast cancer or ovarian cancer before age 40 [1]
Additional Risks:	
10	Women with history of radiation to the chest between ages 10 and 30; breast screening should start 8 to 10 years post-therapy, or at age 25, whichever comes first.
11	Li-Fraumeni Syndrome (TP53 mutation) should start annual breast screening MRI starting at age 20, or at the age of the earliest diagnosed breast cancer in the family, if below age 20 years of age

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Breast MRI Indications - Practice Notes

MRI should not be used in lieu of mammographically, clinically, and/or sonographically suspicious findings (ACR Practice Guidelines).

CH-25.7 Nipple Discharge/Galactorrhea

- ✓ Mammogram should be obtained and ultrasound (CPT® 76641: unilateral, complete or CPT® 76642: unilateral, limited) as initial imaging:
  - If mammogram and ultrasound are negative, a ductal excision is indicated. A ductogram may be useful to exclude multiple lesions and to localize lesions before surgery.
  - Ductal excision is indicated even if the ductogram is negative.
  - An MRI may be considered if a ductogram is technically limited
  - For a **BI-RADS™** 4 or 5 based on mammogram and/or ultrasound, biopsy is indicated.

Practice Notes - Nipple Discharge/Galactorrhea

For milky discharge, prolactin and TSH levels are recommended to diagnose prolactinoma; pituitary imaging is not needed if normal serum Prolactin

CH-25.8 Breast Pain (Mastodynia)

- ✓ Mammogram and ultrasound are the initial imaging for breast pain
- ✓ Advanced imaging is NOT routinely indicated in patients with breast pain and negative evaluation (evaluation includes patient history and physical exam, pregnancy test, mammogram and ultrasound (CPT® 76641: unilateral, complete or CPT® 76642: unilateral, limited).
  - If evaluation is not negative, see **CH-25.5 Breast MRI Indications**

Breast Pain – Practice Notes

The risk of malignancy following a negative examination has been estimated to be only 0.5%.[9]

CH-25.9 Newer Breast Imaging Techniques

- ✓ Positron-Emission Mammography (PEM) or Naviscan® (See: **CH-33.3**)
- ✓ Scintimammography
  - Nuclear medicine study that uses a radioisotope such as Tc-99 tetrofosmin to image the breast. Breast cancer typically shows increased uptake of the radioisotope compared to benign lesions.
  - There is insufficient data currently to generate appropriateness criteria for the use of scintimammography.
  - Scintimammography is not currently an eviCore contracted service.

CH 25.10: Suspected Breast Cancer in Males

- ✓ For men <25 years of age with an indeterminate palpable mass, ultrasound is recommended as initial imaging followed by mammography if ultrasound is inconclusive or suspicious.
- ✓ For men ≥25 years of age with an indeterminate palpable mass or with a concerning physical examination, mammography is recommended initially followed by ultrasound if mammography is inconclusive or suspicious.
- ✓ There is limited evidence on the use of MRI in the evaluation of male breast disease.

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CH-26~Pulmonary Arteriovenous Fistula (AVM)

CH-26.1 Pulmonary AVM

- ✓ Chest CT with contrast, chest CTA (preferred modality) (CPT® 71275), or chest MRA (CPT® 71555) or can be obtained for evaluation of:
  - Suspected pulmonary AVM
  - First degree relatives of a patient with a primary pulmonary AVM
  - Evaluation of patients with paradoxical embolus/stroke and no evidence of patent foreman ovale on echocardiogram.

Practice Notes

Pulmonary AVMs are abnormal connections between pulmonary arteries and veins, usually found in the lower lobes, that can be either primary or acquired (such as trauma, bronchiectasis). They can be identified in up to 98% of chest x-rays by a peripheral, circumscribed, non-calcified lesion connected by blood vessels to the hilum of the lung. Treatment is often by surgery or embolization of the feeding artery using platinum coils or detachable balloons.

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CH-27~PULMONARY EMBOLISM (PE)

CH-27.1 Pulmonary Embolism

- ✓ Chest CT with contrast with PE protocol (CPT® 71260) or chest CTA (CPT® 71275) would be considered with any one of the 3 from each of both sets.
- ✓ With any one of the 3
  - o Dyspnea, new onset and otherwise unexplained;
  - o Chest Pain, pleuritic;
  - o Tachypnea

AND, with any one of the 3:

- o Abnormal **D-dimer** test;
- o **Wells Criteria score*** higher than 4 points;
- o One Risk Factor** or Symptom** of new onset demonstrating high clinical probability of PE

RISK FACTORS**	SYMPTOMS ATTRIBUTED TO PE**
Immobilization at least 3 days or surgery in last 4 weeks or recent trauma	Signs or symptoms of DVT
Previous history of DVT or PE	Hemoptysis
Cancer actively treated in last 6 months or receiving palliative treatment	Right heart strain or failure
Recent history of a long airplane flight	Systolic BP<90
Use of estrogen-based contraceptives (birth control pills, the patch, and vaginal ring)/Oral estrogen	Syncope
Advanced age (>/=70)	Cough
Congestive heart failure	Heart Rate >100
Obesity (BMI >/= 35)	Palpitations

Well's Criteria for Clinical Probability of PE*	
Clinical signs/symptoms of DVT (at minimum: leg swelling and pain with palpation of the deep veins)	3
PE is likely or equally likely diagnosis	3
Heart rate >100	1.5
Immobilization at least 3 days or surgery in last 4 weeks	1.5
Previous history of DVT or PE	1.5
Hemoptysis	1
Cancer actively treated in last 6 months or receiving palliative treatment	1
Calculate Probability: Low <2 Moderate 2 to 6 High >6	
Using the above criteria, only 3% of patients with a low pretest probability had PE versus 63% of those with a high pretest probability.	

- ✓ Non-urgent cases which do not meet above 2-step criteria, should undergo prior to advanced imaging:
  - Chest x-ray (to rule out other causes of acute chest pain)
  - Primary cardiac and pulmonary etiologies should be eliminated.
- ✓ Pregnant women with suspected PE are suggested to proceed with
  - D-dimer and/or;
  - Doppler studies of the lower extremities;
  - V/Q preferred if Doppler negative; Chest CTA (CPT® 71275) or chest MRA (CPT® 71555) can be performed if V/Q scanning is not available.
- ✓ Ventilation-perfusion scans, also called VQ, scans (CPT® 78580-Pulmonary Perfusion Imaging; CPT® 78582-Pulmonary Ventilation (e.g., Aerosol or Gas) and Perfusion Imaging)
  - Is not a replacement for CTA Chest, is can be done and not contraindicated (22-31)
  - Can be considered in any of the following: (22-31)
    - Suspected pulmonary embolism if there is a contraindication to CT or CTA of the chest (ventilation-perfusion scans CPT® 78582)
    - Suspected pulmonary embolism when a Chest x-ray is negative and CTA Chest is not diagnostic (CPT® 78580 or CPT® 78582)
    - Follow-up of an equivocal or positive recent ventilation-perfusion lung scan to evaluate for interval change (CPT® 78580)

- ✓ Follow-up Imaging in Stable or Asymptomatic Patients with Known PE is not warranted
  - Chest CT with contrast with PE protocol (CPT® 71260) or chest CTA (CPT® 71275) can be performed for any of the following indications:
    - Recurrent signs or symptoms such as dyspnea, or
    - Elevated d-dimer which is persistent or recurrently elevated, or
    - Right heart strain or failure identified by EKG, ECHO or Heart catheterization

Practice Notes

Pulmonary embolism is found in approximately 10% of all those that present with suspicion of PE. Dyspnea, pleuritic chest pain and tachypnea occur with about 50% incidence with leg swelling or pain just over 50%.

D-dimer level has a high sensitivity and low specificity for diagnosing PE.

- A negative D-dimer in combination with low or moderate PE risk classification has a negative predictive value approaching 100%.
- D-dimer can be falsely elevated with recent surgery, injury, malignancy, sepsis, diabetes, pregnancy, or other conditions where fibrin products are likely to be present.

CT imaging has supplanted V/Q scanning since the latter is difficult to obtain quickly, does not provide a substantial cost savings, and does not diagnose other pulmonary pathology.

The decision to terminate anticoagulation treatment after previous pulmonary embolism (PE) with absent or stable symptoms is based on clinical evaluation and risk factors.

- Repeat studies do not allow one the ability to distinguish new from residual clot, with luminal diameter and clot character poorly correlated to symptoms and ECHO findings.
- Two thirds after primary thromboembolism have residual pulmonary artery clot at 6 months and 50% remains at one year.
- Subsequent persistence or elevation of D-dimer is associated with increased risk of recurrent PE. ECHO and Right Heart Catheterization (RHC) can identify those with pulmonary hypertension. Yet, 1/2 of all have persistent or new pulmonary hypertension after primary thromboembolism and only half of this latter group has dyspnea at rest or exercise intolerance.

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PULMONARY HYPERTENSION

See **PVD-5~Pulmonary Artery Hypertension** in the Peripheral Vascular Disease Imaging Guidelines

CH-28~SUBCLAVIAN STEAL SYNDROME

Occurs from blood flowing up the contralateral vertebral artery to the basilar artery and retrograde down the ipsilateral vertebral artery (reversal of flow) to supply collateral circulation to the arm on the side and past the stenotic or occluded proximal subclavian or innominate artery to perfuse that arm.

CH-28.1 Subclavian Steal Syndrome

- ✓ Initial evaluation should include clinical findings satisfying the symptom complex ***and*** initial imaging with carotid duplex study (CPT® 93882)
  - Satisfying the symptom complex
    - Physical examination findings suggestive of subclavian stenosis include a discrepancy of >15 mmHg in blood pressure readings taken in both upper extremities, delayed or decreased amplified pulses in the affected side, and a bruit in the supraclavicular area on the affected side.
    - Symptoms include vertebral basilar artery insufficiency, vertigo, limb paresis, and paresthesias. Bilateral cortical visual disturbances, ataxia, syncope, and dysarthria occur less frequently.
    - Symptoms of cerebral ischemia may be produced by exercise of the affected arm.
  - Carotid duplex study (CPT® 93882) is the initial and definitive imaging study
    - Reversal of flow in the ipsilateral vertebral artery.
    - If the carotid duplex is not diagnostic for reversal of flow in the ipsilateral vertebral artery, then neurological symptoms should be evaluated according to the Head guidelines.
- ✓ Neck and chest MRA (CPT® 70548 and CPT® 71555) or CTA (CPT® 70498 and CPT® 71275) can be performed for diagnosis in patients with symptoms of vertebrobasilar ischemia if the clinical exam and duplex study are positive, indeterminate, or as preoperative studies if they will substitute for invasive angiography.
- ✓ Upper extremity MRA (CPT® 73225) or CTA (CPT® 73206) can be performed in symptomatic patients if needed to exclude pathology distal to the subclavian artery and if they will substitute for invasive angiography.

See also **HD-21.1 for vertebrobasilar stroke** in the Head Imaging Guidelines.

Treatment options include ligation of the ipsilateral vertebral artery, aorta-subclavian artery bypass graft, or subclavian endarterectomy.

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CH-29~Superior Vena Cava (SVC) Syndrome

CH-29.1 SVC Syndrome

- ✓ Chest CT with contrast (CPT® 71260) is the initial imaging studies of choice for the evaluation of suspected SVC syndrome based on the facial cyanosis and UE swelling without anasarca
- ✓ MRV (CPT® 71555) or CTV (CPT® 71275) of the chest may be indicated when stenting of the SVC is being considered.

Practice Notes

SVC syndrome is caused by acute or subacute, intrinsic or extrinsic obstruction of the SVC, most commonly from lung cancer (80-85%) and less often benign (fibrosis, mediastinitis, indwelling devices). Other symptoms include dyspnea, headache and dizziness.

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CH-30~THORACIC AORTA

Thoracic aortic diseases are variable and critical; selected imaging procedures are dependent upon the physicians' preference and expertise. As a result, all thoracic imaging in this section (**CH-30)** can be ***one*** of the following studies listed in the table below:

Table of Thoracic Aorta Imaging Options
CT of chest, and/or abdomen, and/or pelvis (contrast as requested);
MRI of the chest, and/or abdomen, and/or pelvis without contrast OR without and with contrast;
CTA of chest, and/or abdomen, and/or pelvis (CPT® 71275, CPT® 74175, CPT® 72191);
MRA of chest, and/or abdomen, and/or pelvis (CPT® 71555, CPT® 74185, CPT® 72198)

CH-30.1 Aortic Dissection

Classic symptoms of sharp, severe acute onset of retrosternal or interscapular chest pain is seen in 96% and is best adapted to the emergent setting. CXR is imprecise; any suspicion should be considered since up to 10% present without classic symptoms.

- ✓ For suspected aortic dissection, conduct CTA or MRA of the entire aorta (including arch branches) and extending through the femoral arteries
- ✓ For follow-up, any requested imaging from the **"Table of Thoracic Aorta Imaging Options"** can be performed
  - "Medically" treated (usually type B)
    - Every 6 months if total aortic diameter is ≥4.5 cm
    - Annually if total aortic diameter is <4.5 cm
  - Surgery or Stent for any type dissection (A or B)
    - First Year: 1 month, 3 months, 6 months, 12 months, then annually

CH-30.2 Thoracic Aortic Aneurysm (TAA)

- ✓ For suspected TAA, any requested imaging from the **"Table of Thoracic Aorta Imaging Options"** above:
  - Abnormalities identified on Chest –x-ray (abnormality including widened mediastinal) or other imaging studies (fluoroscopy, spine MRI, etc.) abnormality
- ✓ For known TAA and chest pain or back pain, any requested imaging from the **"Table of Thoracic Aorta Imaging Options"** above

- ✓ For follow-up, any requested imaging from the **"Table of Thoracic Aorta Imaging Options"** above for the following:
  - "Medically" treated/observation
    - 3.5 to 4.4 cm TAA can be followed annually
    - >/= 4.5 cm TAA can be followed every 6 months
    - >/= 3.0 cm TAA when there is concern for growth can have a one-time 3 month interval advanced imaging
  - Surgery or Stent
    - Preoperative open or endovascular (stent) repair imaging is appropriate
    - Suspicion of endoleak
    - Open Repair imaging every 3 to 5 years
  - Endovascular graft/stent
    - First year: 1 month, 3 months, 6 months, 12 months, then annually
- ✓ Screening with Abdominal Aortic Aneurysm (AAA)
  - Known TAA can be screened for AAA using Abdominal Imaging Guidelines (usually US) See: **AB-17.1 Abdominal Aortic Aneurysm**
  - Known AAA screening for TAA is not supported by sufficient evidence

For educational information on the normal size of the aortic arch and descending thoracic, see Practice Notes.

CH-30.3 Screening Guidelines for Familial Syndromes

- ✓ Screening for Familial Syndromes and Genetic Syndromes
  - **Suspected** Familial Thoracic Aortic Aneurysm
    - ECHO (CPT® 93306, CPT® 93307, or CPT® 93308) and CXR for all First-degree relatives (parents, siblings, children) of patients with TAA and/or dissection
  - Any imaging listed can be performed if these studies identify a TAA or are equivocal or do not visualize the ascending aorta adequately
  - **Follow-Up** per TAA Follow-Up guidelines
- ✓ Screening for Marfan Syndrome or Ehlers-Danlos Syndrome, Vascular form or Type IV
  - **Suspected**, ECHO (CPT® 93306, CPT® 93307, or CPT® 93308) at the time of diagnosis.
  - **Follow-up:**
    - Annual ECHO (CPT® 93306, CPT® 93307, or CPT® 93308) or per TAA Follow-Up guidelines

For educational information on familial TAA, see Practice Notes.

CH-30.4 Thoracic Aorta in Indiviuals with Bicuspid Aortic Valve

- ✓ Screening for Bicuspid Aortic Valve
  - **Suspected**, any requested imaging from the **"Table of Thoracic Aorta Imaging Options"** and/or ECHO (CPT® 93306, CPT® 93307, or CPT® 93308)
    - Additional imaging such as cardiac MRI, cardiac CT, or CCTA is NOT generally indicated.
    - There is no evidence-based data to support screening relatives of patients with bicuspid aortic valve.
  - **Follow-up** per TAA Follow-Up guidelines
    - If no dilatation of the aortic root or ascending thoracic aorta is found, there is no evidence-based data to support continued surveillance imaging.

For more educational information on the Bicuspid Aortic Valve, see Practice Notes

For Coarctation; see **CD-6.2.4**, **CD-6.2.5**, **PEDPVD-4.1**, **PEDAB-14**, **PEDCD-2.3**

Practice Notes

Aortic Dissection

There are two general types of aortic dissection:

1. **Type A:** Those that begin in the ascending aorta
2. **Type B:** Those that begin from just distal to the left subclavian artery branch of the aorta

Type A often requires urgent surgical intervention with placement of an aortic graft or endovascular stent graft.

Type B can usually be treated medically with careful blood pressure control. Surgery is reserved for distal dissections that are leaking, ruptured, or compromising blood flow to a vital organ, or if there is inability to control the blood pressure. Transesophageal echo may be equally diagnostic compared to CT or MRI.

Routine follow-up imaging is important because 30%-40% of chronic dissections will become aneurysmal in 5 years and will require intervention, with less patent false lumina at higher risk.

Penetrating ulcer (through the intima) and intramural hematoma (no intimal tear) are variant forms of aortic dissection and should follow that of aortic dissection, since they are considered precursors of aortic dissection.

TAA

The normal size of the aortic arch and descending thoracic aorta is 3 cm. The aortic root is normally 3.5 cm:

- TAA occurs most often in the descending (50%) and then equally likely in the

ascending or arch aorta.

- Risk factors include atherosclerosis, prolonged hypertension and trauma with mean age 65.
- Risk of rupture is 0% if < 4 cm and 31% if > 6 cm, which is when surgery is often recommended.

Familial TAA

Familial TAA presents at an earlier age, has a faster aortic growth rate, is seen in about 20% or non-Marfan TAA and has autosomal dominant inheritance, when compared to non-familial TAA.

Bicuspid Aortic Valve

Since 20% of individuals who underwent bicuspid aortic valve surgery had concurrent ascending aortic aneurysms that needed repair. All patients with bicuspid aortic valve should have both the aortic root and ascending thoracic aorta evaluated for evidence of aortic dilatation.

References

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2. Elefteriades JA. Natural history of thoracic aortic aneurysms: indications for surgery, and surgical versus nonsurgical risks. *Ann Thorac Surg* 2002;74:S1877-S1880.
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8. Song JK, Yim JH, Ahn JM, et al. Outcomes of patients with acute type A aortic intramural hematoma. *Circulation* 2009;120;2046-2052.
9. Tadros TM, Klein MD, and Shapira OM. Ascending aortic dilatation associated with bicuspid aortic valve. *Circulation* 2009;119:880-890.

CH-31~Elevated Hemidiaphragm

CH-31.1 Elevated Hemidiaphragm

- ✓ Chest CT with contrast (CPT® 71260) and neck CT with contrast (CPT® 70491) (if requested) with new diaphragmatic paralysis after:
  - Previous available chest x-rays reviewed to determine if the diaphragm was previously elevated, *and/or*
  - Fluoroscopic examination ("sniff test") to differentiate true paralysis from weakness
- ✓ CT abdomen with contrast (CPT® 74160) to rule out liver or abdominal process if Chest CT is negative
- ✓ Repeat advanced imaging studies in the absence of new signs or symptoms are not indicated.

Practice Notes:

- The right hemidiaphragm sits about 2 cm higher than the left.
- "Eventration" is thin membranous replacement of muscle, usually on the right, as the most common cause of elevation.
- Any injury to the phrenic nerve from neck to diaphragm can lead to paralysis.
- Common phrenic causes are traumatic or surgical injury or malignancy involving the mediastinum.
- Any loss of lung volume or increased abdominal pressure can lead to diaphragm elevation.

References

1. Ko MA and Darling GE. 2009. Acquired paralysis of the diaphragm. *Thorac Surg Clin* 19(4): 501-510.
2. Qureshi A. 2009. Diaphragm paralysis. *Semin Respir Crit Care Med* 30(3): 315-320.

CH-32~Thoracic Outlet Syndrome (TOS)

CH-32.1 Thoracic Outlet Syndrome

- ✓ Chest X-ray after the current episode of symptoms started or changed should be performed initially in all cases since it can identify bone abnormalities or other causes of right upper extremity pain.
- ✓ MR imaging is the preferred imaging modality in patients with suspected TOS
  - Chest MRI (CPT® 71550) or upper extremity other than joint MRI (CPT® 73218)
  - Neck and chest MRA (CPT® 70548 and CPT® 71555) can be used in place of MRI with suspected arterial or venous TOS
  - CT Chest with contrast or CT Neck with contrast can be used in place of MRI if:
    - Suspected anomalous ribs or fractures, as bone anatomy is more easily definable at CT
    - Postoperative patients in whom there is a question of a remnant first rib.
    - Dialysis-dependent renal failure, claustrophobia, or implanted device incompatibility
- ✓ Also see **PN-4~Brachial Plexus** in the Peripheral Nerve Disorders Guidelines

Practice Notes

TOS refers to compression of the subclavian vessels and/or brachial plexus at the thoracic outlet of the chest (the area bounded by the two scalene muscles and the first rib).

There are 3 types, with neurogenic seen in 80%, venous (also called effort thrombosis) 15% and the remaining 5% arterial.

Since this is such a rare entity and diagnosis is difficult, specialist evaluation by a vascular surgeon or thoracic surgeon is helpful in determining the appropriate imaging pathway.

Reference

1. Raptis C, Sridhar S, Thompson R, Fowler K, Bhalla S. Imaging of the Patient with Thoracic Outlet Syndrome. RadioGraphics, 2016: 36: 984-1000..

CH-33~NEWER IMAGING TECHNIQUES

CH-33.1 Virtual Bronchoscopy

- ✓ There is insufficient data currently to generate appropriateness criteria for the use of virtual bronchoscopy, and this procedure should be considered investigational at this time.
- ✓ Virtual bronchoscopy uses multidetector CT with 3D rendering (CPT® 71260 and CPT® 76377) to generate an image of the tracheobronchial tree down to the level of the sixth- to seventh-generation bronchi, and can visualize areas inaccessible to the flexible bronchoscope.

CH-33.2 EM-Guided Peripheral Bronchoscopy

- ✓ EM Guided Peripheral Bronchoscopy is currently an experimental/investigational procedure. Current evidence does support its use in performing biopsies of peripheral lesions of the lungs.
- ✓ Peripheral bronchoscopy using electromagnetic (EM) navigational guidance on a CT road map is a technology for performing biopsies of peripheral lesions of the lungs.
- ✓ Clinical trials are currently underway to evaluate this technique for mediastinal lymph node biopsies.

Coding Notes

- Planning is included in the navigational bronchoscopy code (CPT® +31627).
- Neither separate unlisted codes, (CPT® 76499 or CPT® 76497), nor other diagnostic CT codes are not reported for the planning phase and pre-procedure imaging acquisition.
- 3D Rendering, (CPT® 76376 and CPT® 76377), is not reported in conjunction with CPT® 31627.

CH-33.3 Positron Emission Mammography

- ✓ There is currently insufficient data to generate appropriateness criteria for this modality, and this procedure should be considered investigational at this time.
- ✓ High-resolution positron-emission mammography (PEM) by Naviscan™ PET Systems, also referred to as Naviscan™ or PET mammography, performs high-resolution metabolic imaging of breast cancer using FDG tracer. The PEM detectors are integrated into a conventional mammography system, allowing acquisition of the emission images immediately after the mammogram.

- ✓ Requesting providers often ask for PEM as CPT® 78811 or "PET scan of the breast."
- ✓ The spatial resolution of this technique is at the individual duct level (1.5 mm) and allows visualization of intraductal as well as invasive breast cancers. This technique is especially adept at detecting ductal carcinoma in situ.
- ✓ Early clinical trials have shown high clinical accuracy in characterizing lesions identified as suspicious on conventional imaging or physical examination, as well as detecting incidental breast cancers not seen on other imaging modalities.
- ✓ A prospective multi-center clinical trial for women with newly diagnosed breast cancer anticipating breast-conservation surgery was performed. These women underwent both high-resolution PEM imaging and breast MRI. Results showed that PEM and MRI had comparable breast-level sensitivity, although MRI had greater lesion-level sensitivity and more accurately depicted the need for mastectomy. PEM had greater specificity at the breast and lesion levels. 3.6% of the women had tumors seen only at PEM.
- ✓ The radiation exposure from a PEM study is 23 times higher than for digital mammography.

References

1. Tafra L, Cheng Z, Uddo J, et al. Pilot clinical trial of 18F-fluorodeoxyglucose positron-emission mammography in the surgical management of breast cancer. *Am J Surg* 2005 Oct;190(4):628-632.
2. Murthy K, Aznar M, Thompson CJ. Results of preliminary clinical trials of the positron emission mammography system PEM-I: a dedicated breast imaging system producing glucose metabolic images using FDG. *J Nucl Med* 2000 Nov;41(11):1851-1858.
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CH-34~LUNG TRANSPLANTATION

CH-34.1 Pre-Transplant Imaging Studies

- ✓ Individuals on the waiting list or being considered for the lung transplant can undergo advanced imaging per that institution's protocol as long as the studies do not exceed the following:
  - Chest CT with and without contrast (CPT® 71270), chest CT with (CPT® 71260), or chest CT without contrast (CPT® 71250),
  - ECHO,
  - Imaging Stress Test (MPI, SE, MR) or Heart Catheterization (Right and Left); Heart catheterization can also be done after a positive stress test.
- ✓ Other studies that will be considered include V/Q scan, Six Minute Walk.
- ✓ Initial post-transplant follow-up: CT chest with and without contrast (CPT® 71270), CT chest with (CPT® 71260), or CT chest without contrast (CPT® 71250).
  - Requests for subsequent follow-up imaging will go to Medical Director review.
- ✓ See: **CD-1.6 Transplant Patients**

Reference

1. Imaging of Lung Transplantation Review, *American Journal of Roentgenology* Vol_ 192, No_ 3_supplement (AJR).htm.