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1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

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# Chest Imaging Guidelines

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<td>AAA</td>
<td>abdominal aortic aneurysm</td>
</tr>
<tr>
<td>ACE</td>
<td>angiotensin-converting enzyme</td>
</tr>
<tr>
<td>AVM</td>
<td>arteriovenous malformation</td>
</tr>
<tr>
<td>BI-RADS</td>
<td>Breast Imaging Reporting and Database System</td>
</tr>
<tr>
<td>BP</td>
<td>blood pressure</td>
</tr>
<tr>
<td>CAD</td>
<td>computer-aided detection</td>
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<tr>
<td>COPD</td>
<td>chronic obstructive pulmonary disease</td>
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<tr>
<td>CT</td>
<td>computed tomography</td>
</tr>
<tr>
<td>CTA</td>
<td>computed tomography angiography</td>
</tr>
<tr>
<td>CTV</td>
<td>computed tomography venography</td>
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<tr>
<td>DCIS</td>
<td>ductal carcinoma in situ</td>
</tr>
<tr>
<td>DVT</td>
<td>deep venous thrombosis</td>
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<tr>
<td>ECG</td>
<td>electrocardiogram</td>
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<tr>
<td>EM</td>
<td>electromagnetic</td>
</tr>
<tr>
<td>EMG</td>
<td>electromyogram</td>
</tr>
<tr>
<td>FDG</td>
<td>fluorodeoxyglucose</td>
</tr>
<tr>
<td>FNA</td>
<td>fine needle aspiration</td>
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<tr>
<td>GERD</td>
<td>gastroesophageal reflux disease</td>
</tr>
<tr>
<td>GI</td>
<td>gastrointestinal</td>
</tr>
<tr>
<td>HRCT</td>
<td>high resolution computed tomography</td>
</tr>
<tr>
<td>IPF</td>
<td>idiopathic pulmonary fibrosis</td>
</tr>
<tr>
<td>LCIS</td>
<td>lobular carcinoma in situ</td>
</tr>
<tr>
<td>LFTP</td>
<td>localized fibrous tumor of the pleura</td>
</tr>
<tr>
<td>MRA</td>
<td>magnetic resonance angiography</td>
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<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
</tr>
<tr>
<td>MRV</td>
<td>magnetic resonance venography</td>
</tr>
<tr>
<td>NCV</td>
<td>nerve conduction velocity</td>
</tr>
<tr>
<td>PE</td>
<td>pulmonary embolus</td>
</tr>
<tr>
<td>PEM</td>
<td>positron-emission mammography</td>
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<tr>
<td>PET</td>
<td>positron emission tomography</td>
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<tr>
<td>Abbreviation</td>
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<tr>
<td>PFT</td>
<td>pulmonary function tests</td>
</tr>
<tr>
<td>PPD</td>
<td>purified protein derivative of tuberculin</td>
</tr>
<tr>
<td>RODEO</td>
<td>Rotating Delivery of Excitation Off-resonance MRI</td>
</tr>
<tr>
<td>SPN</td>
<td>solitary pulmonary nodule</td>
</tr>
<tr>
<td>SVC</td>
<td>superior vena cava</td>
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CH-1: General Guidelines

A current clinical evaluation (within 60 days) is required prior to considering advanced imaging.

- A clinical evaluation should include the following:
  - A relevant history and physical examination.
  - Appropriate laboratory studies and non-advanced imaging modalities, such as plain x-ray or ultrasound.
  - Other meaningful contact (telephone call, electronic mail or messaging) by an established individual can substitute for a face-to-face clinical evaluation.

CH-1.1: General Guidelines – Chest X-Ray

- A recent chest x-ray (generally within the last 60 days) that has been over read 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 disease and may direct proper advanced imaging for such conditions as:
    - Pneumothorax, (See CH-19: Pneumothorax/Hemothorax).
    - Pneumomediastinum, (See CH-19: Pneumothorax/Hemothorax).
    - Fractured ribs, (See CH-22: Chest Wall Mass).
    - Acute and chronic infections, and (See CH-13: Pneumonia and CH-14: Other Chest Infections).
    - Malignancies.
  - Exceptions to preliminary chest x-ray may include such conditions as:
    - Supraclavicular lymphadenopathy (See CH-2.1: Supraclavicular Region).
    - Known Bronchiectasis (See CH-7: Bronchiectasis).
    - Suspected Interstitial lung disease (See CH-11: Interstitial Disease).
    - Positive PPD or tuberculosis (See CH-14: Other Chest Infections).
    - Suspected Pulmonary AVM (See CH-26: Pulmonary Hypertension).

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: 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 – CT Chest

- Intrathoracic abnormalities found on chest x-ray, fluoroscopy, abdominal CT scan, or other imaging modalities may be further evaluated with CT Chest with contrast (CPT® 71260).
  ✦ Abnormalities not addressed in these guidelines should be sent for Medical Review

- CT Chest without contrast (CPT® 71250) can be used for the following:
  ✦ Individual has contraindication to contrast.
  ✦ Follow-up of pulmonary nodule(s).
  ✦ High Resolution CT (HRCT).
  ✦ Low-dose CT Chest (CPT® G0297) See CH-34: Lung Cancer Screening.

- CT Chest without and with contrast (CPT® 71270) does not add significant diagnostic information above and beyond that provided by CT Chest with contrast, unless a question regarding calcification, most often within a lung nodule, needs to be resolved.¹

CT Chest Coding Notes:

- High resolution CT Chest 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 – CTA Chest (CPT® 71275)

- CTA Chest (CPT® 71275) can be considered for suspected Pulmonary Embolism and Thoracic Aortic disease.
  ✦ CTA prior to minimally invasive or robotic surgery (See CD-4.8: Transcatheter Aortic Valve Replacement (TAVR) in the Cardiac Imaging Guidelines).

CH-1.5: General Guidelines – Chest MRI without and with Contrast (CPT® 71552)

- Indications for MRI Chest are infrequent and may relate to concerns about CT contrast such as renal insufficiency or contrast allergy. MRI may be indicated:
  ✦ 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 include:
      ✦ Chest muscle tendon injuries (MS-11: Muscle/Tendon Unit Injuries/Diseases).
      ✦ Brachial plexopathy (PN-4: Brachial Plexus).
      ✦ Thymoma (ONC-10.5: Thymoma).
CH-1.6: This section intentionally left blank

References
# CH-2: Lymphadenopathy

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<td>CH-2.3: Mediastinal Lymphadenopathy</td>
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CH-2.1: Supraclavicular Region

- Ultrasound (CPT® 76536) is the initial study for palpable or suspected lymphadenopathy.
  - Allows simultaneous ultrasound-guided fine needle aspiration (FNA) (CPT® 76942).
  - CT Neck with contrast (CPT® 70491) or CT Chest with contrast (CPT® 71260) if ultrasound is indeterminate.
    - See NECK-1: General in the Neck Imaging Guidelines.

CH-2.2: Axillary Lymphadenopathy

- There is no evidence-based support for advanced imaging of clinically evidenced axillary lymphadenopathy without biopsy. ²,³
  - 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 or ultrasound directed core needle 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.

- Occult Primary Cancer in axillary lymph node(s):
  - See ONC-31: Metastatic Cancer, Carcinomas of Unknown Primary Site, and Other Types of Cancer.

Background and Supporting Information
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.

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).
CH-2.3: Mediastinal Lymphadenopathy

CT Chest with contrast (CPT® 71260) if mediastinal abnormalities are detected on a chest x-ray (over read by a radiologist) or other non-dedicated advanced chest imaging.

Follow-up CT Chest (CPT® 71260) after 4 weeks 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 CT Chest; or
  - Suspected malignancy.

Background and Supporting Information

- 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 CT or ultrasound directed 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
CH-3.1: Cough

- Initial evaluation should include a recent chest x-ray after the current episode of cough started or changed.\(^1,2\)
  - In addition all medications known to cause coughing (e.g. ACE inhibitors, Sitagliptin) should be discontinued.\(^1,2,3\)

- CT Chest (either with contrast [CPT\(^®\) 71260] or without contrast [CPT\(^®\) 71250]), if the initial chest x-ray is without abnormalities and all medications known to cause coughing have been discontinued, for the following:
  - Non-Smoker cough after the following sequence for a total 3 week trial and investigation after ALL of the following:\(^4\)
    - Antihistamine and decongestant treatment.\(^1,2\)
    - Empiric trial of corticosteroids.\(^1,2\)
    - Treatment of gastroesophageal reflux disease (GERD).\(^1,2\)
      - See HD-29: Sinusitis.
  - Current or past cigarette smokers with either:\(^4\)
    - New cough lasting greater than 2 weeks
    - Changed chronic cough in worsening frequency or character
      - See CH-6: Hemoptysis.
  - CT Maxillofacial without contrast (CPT\(^®\) 70486) or limited sinus CT without contrast (CPT\(^®\) 76380) can be considered in those with suspicion of Upper Airway Cough Syndrome (UACS) secondary to rhinosinus disease\(^4\)
  - For any abnormalities present on the initial chest x-ray, advanced chest imaging can be performed according to the relevant Chest Imaging Guidelines section\(^1\).

Background and Supporting Information

- 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.\(^2\) Smoking cessation is “almost always effective” in resolving cough in smoker.\(^2\)
- Cough after URI (Upper Respiratory Infection) can typically last beyond 2-3 weeks.\(^3\)

References

## CH-4: Non-Cardiac Chest Pain

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<tr>
<td>CH-4.2: Costochondritis/Other Musculoskeletal Chest Wall Syndrome</td>
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</table>
CH-4: Non-Cardiac Chest Pain

See the following guidelines:
- CH-25: Pulmonary Embolism (PE).
- CH-29.1: Aortic Dissection.
- CD-1: General Guidelines.

"Evidence is not conclusive whether Triple-rule-out CT (CAD, PE, and AD) will improve efficiency of individual 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.\(^1,2\)
- CT Chest with contrast (CPT\(^\text{®}\) 71260) or CTA chest with contrast (CPT\(^\text{®}\) 71275) if x-ray is abnormal.\(^1,2,3,4\)
- If x-ray is normal, individual 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 evaluation\(^1,2\) (See Cardiac imaging guidelines CD-1: General Guidelines)
  - GI any ONE of the following:
    - Trial of anti-reflux medication, or pH probe, or esophageal manometry\(^1\) or
    - Barium swallow or endoscopy
  - Either a barium swallow, esophageal pH monitoring, manometry, or endoscopy should be done in all after cardiac causes have been ruled out since GERD is the cause in almost 60%
  - Pulmonary Function Test (PFT’s).\(^1,2\)
- CT Chest with contrast (CPT\(^\text{®}\) 71260) if persistent:
  - The initial chest x-ray reveals no abnormalities; and either
    - Sickle cell disease\(^2\), or
    - Suspected lung mass in an individual 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.

Background and Supporting Information
Chest x-ray could identify pneumothorax, pneumomediastinum, fractured ribs, acute and chronic infections, and malignancies.
Costochondritis can be readily diagnosed with palpation tenderness and/or hooking maneuver and imaging is non-specific.\(^3\)
References


### CH-5: Dyspnea/Shortness of Breath

| CH-5.1: Dyspnea/Shortness of Breath | 18 |
| CH-5.2: This section intentionally left blank | 18 |
CH-5.1: Dyspnea/Shortness of Breath

- Initial evaluation should include a recent chest x-ray.\textsuperscript{1,2}
  - CT Chest without contrast (CPT\textsuperscript{®} 71250) if x-ray is abnormal.\textsuperscript{1,2}
  - CT Chest without contrast (CPT\textsuperscript{®} 71250, including HRCT), or CT Chest with contrast (CPT\textsuperscript{®} 71260) if the initial chest x-ray is indeterminate and the following evaluations have been conducted and are indeterminate:\textsuperscript{2}
    - ECG, echocardiogram or stress testing,\textsuperscript{2} and
    - Pulse oximetry and pulmonary function studies (PFT’s),\textsuperscript{2}

Background and Supporting Information

Dyspnea is the subjective experience of breathing discomfort.

References


CH-5.2: This section intentionally left blank
CH-6.1: Hemoptysis

- 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 (≥30 cc per episode or unable protect airway).¹

- Chest CT with contrast (CPT® 71260) OR without contrast (CPT® 71250) can be considered if meets above guidelines but there is a contraindication to iodinated contrast or in place of CTA.¹

Reference

CH-7.1: Bronchiectasis – Imaging

- High resolution CT Chest scan (HRCT) without contrast (CPT® 71250) for ANY of the following:4, 5
  - To confirm suspected diagnosis of bronchiectasis after an initial x-ray1, 2.
  - For known bronchiectasis with worsening symptoms or worsening PFT's2.
  - For hemoptysis with known or suspected bronchiectasis.3

References
<table>
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<th>CH-8: Bronchitis</th>
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<tr>
<td>CH-8.1: Bronchitis</td>
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</table>
CH-8.1: Bronchitis

- Advanced imaging is not needed for bronchitis.\textsuperscript{1,2}
- Chest x-ray to determine if any abnormality is present.

References
**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 Chest should not be used to screen populations at risk for asbestos-related diseases.\(^2\)

- High resolution CT Chest (HRCT) (CPT® 71250) for ANY of the following:\(^2\)
  - Any change seen on chest x-ray.
  - Progressive respiratory symptoms that may indicate the development or progression of asbestos related interstitial fibrosis.
  - Send requests for additional follow-up imaging to Medical Director for review.

**Background and Supporting Information**

- 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.

**References**


**CH-10.1: COPD – Imaging**

- Chest x-ray should be performed initially.
  - CT Chest without contrast (CPT® 71250) or CT Chest with contrast (CPT® 71260)\(^1,2\) can be performed if:
    - Emphysema is known or suspected and a pre-operative study for Lung Volume Reduction Surgery (LVRS) is being requested.\(^1\) OR
    - Definitive diagnosis is not yet determined by laboratory studies and chest x-ray and ONE of the following is suspected:
      - Bronchiectasis
      - Sarcoidosis
      - Emphysema
      - Pneumoconiosis
      - Idiopathic pulmonary fibrosis
      - Langerhans cell histiocytosis
      - Hypersensitivity pneumonitis
      - Bronchioitis obliterans
      - Lipoid pneumonia
      - Drug toxicity
      - Lymphangitic cancer\(^2\)

- Lung cancer screening is discussed in the following guideline:
  - See “Screening Indications” in **CH-34: Lung Cancer Screening**.

**Background and Supporting Information**

- 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.\(^2\).

**References**

CH-11.1: Interstitial Disease

- High resolution CT Chest (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 individuals with pulmonary symptoms and abnormal pulmonary function studies (PFT’S) (See CH-5: Dyspnea/Shortness of Breath)¹⁻⁶
  - Initial request to identify interstitial disease with a connective tissue disease diagnosis, including:
    - Rheumatoid arthritis,
    - Scleroderma,
    - The myopathies
    - Asbestosis,
    - Silicosis,
    - Coal miner’s lung disease¹⁻⁶
  - New or worsening pulmonary symptoms or worsening PFT’s in any type of interstitial disease, including connective tissue diseases,¹⁻⁶
  - Once a year in individuals with known idiopathic pulmonary fibrosis (IPF) if showing progression or regression of disease will change individual management³

References

CH-12.1: Multiple Pulmonary Nodules

See CH-16: Solitary Pulmonary Nodule (SPN)\textsuperscript{1}

**Background and Supporting Information**

- Increased risk of primary cancer as the total nodule count increased from 1 to 4 but decreased risk in individuals with 5 or more nodules, most of which likely resulted from prior granulomatous infection.\textsuperscript{1}

**References**

**CH-13.1: Pneumonia**

- Chest x-ray would be performed initially in all individuals with suspected pneumonia, prior to considering advanced imaging.\(^1,2\)
  - CT Chest with contrast (CPT\(^\circledast\) 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**


CH-14: Other Chest Infections

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</table>
**CH-14.1: PPD or TB**

- CT Chest with contrast (CPT® 71260) or CT Chest without contrast (CPT® 71250) with ANY of the following:
  - Positive PPD skin test or other positive tuberculin skin tests or suspected active (or reactivated) tuberculosis and a normal or equivocal chest x-ray\(^1\)
  - Suspected complications or progression of tuberculosis (e.g. pleural tuberculosis, empyema, and mediastinitis)\(^2\).

- If CT Chest is unremarkable, there is insufficient data to support performing subsequent CT Chest unless symptoms develop or chest x-ray shows a new abnormality.

- Follow-up CT Chest 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 CT Chest.

**CH-14.2: Fungal Infections**

- CT Chest with contrast (CPT® 71260) or High resolution CT Chest (HRCT) without contrast (CPT® 71250)\(^3,4\):
  - Initial diagnosis of any fungal pneumonia or chest infection\(^3,4\)
  - Suspected complications or progression of the fungal chest infection (e.g. worsening pneumonitis; pleural effusion, empyema, mediastinitis).

- Follow-up CT Chest with contrast (CPT® 71260) or High resolution CT Chest (HRCT) without contrast (CPT® 71250) with frequency at the discretion of the pulmonary specialist.

**CH-14.3: Wegener's Granulomatosis/Granulomatosis with Polyangiitis**

- CT Chest without contrast (CPT® 71250)* should be done in all individuals who have pulmonary symptoms and are newly diagnosed or suspected of having an Antineutrophil cytoplasmic autoantibody (ANCA)-associated vasculitides (AAV) for a baseline prior to initiating immunosuppressive therapy\(^5,6\).

- Selective use of additional imaging is useful in evaluating individuals who are suspected or known to have AAV, including a CT scan of the head (sinuses, orbits, mastoids) in individuals with visual or upper respiratory track symptoms or signs, and a CT scan of the neck (subglottic region) in individuals with symptoms or signs of subglottic stenosis\(^6\).

*In most situations, CT scans in individuals with AAV should be performed without an iodinated contrast agent administered\(^6\).
CH-14.4: Suspected Sternal Dehiscence

- Sternal wound dehiscence is primarily a clinical determination.
- 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.

References
<table>
<thead>
<tr>
<th>CH-15: Sarcoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-15.1: Sarcoid</td>
</tr>
</tbody>
</table>
**CH-15.1: Sarcoid**

CT Chest either with contrast (CPT® 71260) or without contrast (CPT® 71250) for ANY of the following:\(^1\)
- 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.\(^2,3,4\)

There is currently no evidence-based data to support performing serial PET scans to monitor disease activity while tapering steroid therapy.\(^2,3,4\)

See **CD-5.2: Cardiac MRI – Indication (excluding Stress MRI)** and **HD-22: Cerebral: Vasculitis** in the Head Imaging Guidelines.

**References**

# CH-16: Solitary Pulmonary Nodule (SPN)

<table>
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<th>Section</th>
<th>Page</th>
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<tr>
<td>CH-16.4: PET</td>
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</tr>
</tbody>
</table>
**CH-16: Solitary Pulmonary Nodule**

- For Lung Cancer Screening (LDCT) including incidental findings from LDCT, See **CH-34: Lung Cancer Screening**

**CH-16.1: Imaging**

- CT Chest with contrast (CPT® 71260) or CT Chest without contrast (CPT® 71250) initially for discrete nodule(s) in the following scenarios:1,2,3
  - Lung nodule(s) seen on an imaging study other than a “dedicated” CT Chest or MR. Examples of other studies:
    - Chest x-ray
    - Abdominal CT
    - Spine MRI
    - Coronary CTA1
  - But NOT in the following which are considered initial dedicated advanced chest imaging:
    - CT Chest without and with contrast (CPT® 71270)
    - CTA Chest without and with contrast (CPT® 71275)
    - MRI Chest without contrast (CPT® 71550)
    - MRI Chest without and with contrast (CPT® 71552)
    - MRA Chest without and with contrast (CPT® 71555).

- Comparisons should include the earliest available study and the more recent previous CT Chest scans to determine if nodule was present and stable.1 Using largest measurement of multiple lung nodules.1
  - Similar-sized pleural nodule(s) is treated as a pulmonary nodule(s)

- The size of the lung or pleural nodule(s) is crucial information for decisions making regarding follow-up. The largest of multiple lung and/or pleural nodules will guide the surveillance interval. (See **CH-16.2: Incidental Pulmonary Nodules Detected on CT Images**, and **CH-17.1: Pleural-Based Nodules and Other Abnormalities**) Yet, multiple nodules may also change this interval. (See **CH-16.2: Incidental Pulmonary Nodules Detected on CT Images**).

**Background and Supporting Information**

Abnormality examples include: mass, opacity, lesion, density, nodule, and calcification.

If no measurement is provided or if the abnormality is ill defined without measurement or described as scarring, the case should be sent to MD review.
### CH-16.2: Incidental Pulmonary Nodules Follow-up Recommendations

#### Incidentally Detected Solid Pulmonary Nodules Follow-up Recommendations

<table>
<thead>
<tr>
<th>Nodule Type</th>
<th>Size</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Nodule</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nodule Type</td>
<td>&lt;6 mm (&lt;100 mm³)</td>
<td>6–8 mm</td>
</tr>
<tr>
<td><strong>Follow-up (optional) CT at 12 months. No routine follow-up if stable at 12 months</strong></td>
<td>CT at 6–12 months, then CT at 18–24 months if stable</td>
<td>CT at 3 months, then CT at 6–12 and then at 18–24 months if stable. Consider PET/CT or biopsy</td>
</tr>
<tr>
<td><strong>Multiple Nodules</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nodule Type</td>
<td>&lt;6 mm (&lt;100 mm³)</td>
<td>6–8 mm</td>
</tr>
<tr>
<td>*<em>Follow-up (optional) CT at 12 months. <em>No routine follow-up if stable at 12 months</em></em></td>
<td>CT at 3–6 months, then at 18–24 months if stable</td>
<td>CT at 3–6 months, then at 18–24 months if stable. Consider PET/CT or biopsy</td>
</tr>
</tbody>
</table>

#### Incidentally Detected Sub-Solid Pulmonary Nodules Follow-up Recommendations

<table>
<thead>
<tr>
<th>Nodule Type</th>
<th>Size</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Ground glass opacity (GGO)</strong></td>
<td>&lt;6 mm (&lt;100 mm³)</td>
<td>CT at 6–12 months to confirm persistence, then follow-up with CT every 2 years until 5 years</td>
</tr>
<tr>
<td><strong>Single Part-solid</strong></td>
<td>&lt;6 mm (&lt;100 mm³)</td>
<td>CT at 3–6 months to confirm persistence. If unchanged and solid component remains &lt;6 mm, then annual CT should be performed for 5 years. If solid component has suspicious morphology (i.e., lobulated margins or cystic components), is &gt;8 mm or is growing: Consider PET/CT or biopsy</td>
</tr>
<tr>
<td><strong>Multiple Sub-Solid</strong></td>
<td>&lt;6 mm (&lt;100 mm³)</td>
<td>CT at 3–6 months. Consider resection.</td>
</tr>
</tbody>
</table>

(*Following the Fleischner Society Guidelines for high risk which include American College of Chest Physicians intermediate and high risk categories.¹ ²*)
If a PET/CT was found to be negative, follow-up with CT at 6–12 months, then CT at 18–24 months if stable. CT examinations of the thorax performed to follow lung nodules should use a low-radiation technique.

**CH-16.3: Interval Imaging Outcomes**

- No further advanced imaging is necessary if nodule(s) ANY of the following:
  - Has remained stable as described in CH-16.2: Incidental Pulmonary Nodules Follow-up Recommendations
  - Has remained stable on chest x-ray for 5 years
  - Has classically benign characteristics by chest x-ray or previous CT (e.g. benign calcification pattern typical for a granuloma or hamartoma)
  - Is decreasing in size or disappearing.

- Lung nodule(s) that increase in size or number should no longer be considered for CT screening or surveillance.
  - With an increase in nodule(s) size or number, PET (See CH-16.4: PET) as well as tissue sampling or other further diagnostic investigations should be considered.

**CH-16.4: PET**

- PET/CT (CPT® 78815) for a distinct lung nodule ≥8 mm on dedicated advanced chest imaging, as described in CH-16.1: Imaging.
- If there is a history of malignancy, refer to the appropriate Oncology restaging/recurrence guideline for indications for PET imaging.
  - Pleural nodule See CH-17.1: Pleural-Based Nodules and Other Abnormalities.

- Serial PET studies are not considered appropriate.
- PET studies are not appropriate for infiltrate, ground glass opacity, or hilar enlargement.

**Background and Supporting Information**

- 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, 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 100 to 400 days) may be sampled for biopsy or resected.
  - Less than 1% of <6mm lung nodules are malignant.
  - Three per cent of all 8 mm lung nodules are malignant.
  - The larger the solid component of a sub-solid nodule, the greater the risk of invasiveness and metastases.
The risk of primary cancer increases with the total nodule count from 1 to 4.1
There is decreased risk of primary cancer in individuals with 5 or more nodules, most of which likely resulted from prior granulomatous infection.1
A nodule that does not grow in 6 months has a <10% risk of malignancy.

Benign features in solid nodules 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.3

Ground glass or subsolid opacities, which can harbor indolent adenocarcinoma with average doubling times of 3–5 years.1

Repeat PET is discouraged. If the original PET is positive, biopsy may be performed. If the original PET is negative, but subsequent CT Chest shows an increase in nodule size, biopsy may be performed.

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

False negative PET can be seen in individuals with adenocarcinoma in situ, carcinoid tumors, and mucinous adenocarcinomas. With a high pre-test likelihood (80%) of malignancy, negative findings on PET scan reduce the likelihood of malignancy to 14%. In an individual with a low pre-test likelihood (20%) of malignancy, a negative PET scan reduces the likelihood of malignancy to 1%.6

References

CH-17: Pleural-Based Nodules and Other Abnormalities

CH-17.1: Pleural-Based Nodules and Other Abnormalities

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CH-17.1: Pleural-Based Nodules and Other Abnormalities

- CT Chest with contrast (CPT® 71260) or CT Chest without contrast (CPT® 71250) (with contrast is preferred for initial evaluation) for pleural nodule(s).\(^1\)
  - Pleural nodule(s) seen on an imaging study other than a “dedicated” CT Chest or MR.\(^1\)
  - Pleural nodule(s) identified incidentally on any dedicated chest studies can replace CT Chest as the initial dedicated study.\(^1\)
    - 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)
  - After preliminary comparison with any available previous chest films to determine presence and stability.
  - Using largest measurement of multiple nodule(s). (See CH-16.1: Imaging).
  - Following the Fleischner Society Guidelines for high risk. (See CH-16.2: Incidental Pulmonary Nodules Follow-up Recommendations)

- PET/CT (CPT® 78815) 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.\(^1\)

**Background and Supporting Information**

- Pleural nodule/mass or thickening without suggestion of malignancy would undergo surveillance or biopsy.

**Reference**

CH-18.1: Pleural Effusion

- CT Chest with contrast (CPT® 71260) after both:\(^1,2\)
  - Chest x-ray including lateral decubitus films; and
  - Thoracentesis to determine if fluid is exudative or transudative and remove as much as possible (this fluid can obscure the underlying lung parenchyma and possibly a 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 and guide thoracentesis.

Background and Supporting Information

- Bilateral effusions are more often systemic related transudates (congestive heart failure, renal failure, 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


3. **CH-19: Pneumothorax/Hemothorax**

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<tr>
<td>CH-19.2: Pneumomediastinum; Subcutaneous Emphysema</td>
<td>51</td>
</tr>
</tbody>
</table>
CH-19.1: Pneumothorax/Hemothorax

- Chest x-ray initially.
  - CT Chest 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 individual treatment decisions.¹
    - Preoperative study for treatment of pneumothorax.¹
    - Pneumothorax associated with hemothorax.²
    - Suspected complications from hemothorax (e.g. empyema).²
    - Suspected Alpha-1-Antitrypsin Deficiency (even without pneumothorax).³

CH-19.2: Pneumomediastinum; Subcutaneous Emphysema

- Chest x-ray initially.
  - CT Chest with contrast (CPT® 71260) or without contrast (CPT® 71250) if:
    - Recent vomiting and/or suspected esophageal perforation.⁴,⁵
    - Associated pneumopericardium.⁴,⁵
    - Associated pneumothorax.⁴,⁵
    - Preoperative study for treatment.⁴,⁵

Background and Supporting Information

- An expiration chest x-ray can enhance the evaluation of equivocal plain x-ray. There is no data supporting the use of serial CT Chest to follow individuals with a 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

CH-20.1: Mediastinal Mass

- CT Chest with contrast (CPT® 71260) to evaluate mediastinal abnormalities seen on chest x-ray or other non-dedicated chest imaging and can be done once initially if there is a concern for:¹ ² ³
  - Mediastinal cyst including bronchogenic, thymic, pericardial or esophageal in nature
    - CT Chest with contrast (CPT® 71260) or MRI Chest without and with contrast (CPT® 71552) for subsequent evaluations if:
      - New signs or symptoms, or
      - Preoperative assessment

- For Adenopathy; See CH-2: Lymphadenopathy
- For Goiter; See NECK-8.1: Thyroid Nodule.
- For Myasthenia Gravis; See PN-6.1: Neuromuscular Disease

References

**CH-21.1: Chest Trauma**

- Chest X-ray initially.
  - CT Chest without contrast (CPT® 71250) or with contrast (CPT® 71260) for the following situations:\(^1\)
    - Rib\(^1\) or Sternal\(^2\) Fracture:
      - With associated complications identified clinically or by other imaging, including pneumothorax, hemothorax, pulmonary contusion, atelectasis, flail chest, cardiovascular injury and/or injuries to solid or hollow abdominal organs.\(^1\)
      - Uncomplicated, single fractures, multiple fractures, non-acute fractures, or occult rib fractures are NOT an indication for CT Chest unless malignancy is suspected as the etiology.\(^1\)
    - Routine follow-up advanced imaging of rib or sternal fractures is not indicated.\(^1\)
    - CT Chest without contrast (CPT® 71250) or Tc-99m bone scan whole body (CPT® 78306) for suspected pathological rib fractures, with or without a history of trauma.\(^1\)
  - Clavicle Fractures:
    - Proximal (medial) 1/3 fractures or sternoclavicular dislocations can undergo CT and MRI of the chest or shoulder.\(^3\)
    - X-ray is adequate for evaluation of middle and distal 1/3 fractures.\(^3\)

- No advanced imaging of the abdomen or pelvis is indicated when there is chest trauma and no physical examination or laboratory evidence of abdominal and/or pelvic injury.

**References**


<table>
<thead>
<tr>
<th>CH-22: Chest Wall Mass</th>
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<tbody>
<tr>
<td>CH-22.1: Chest Wall Mass</td>
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</tbody>
</table>
**CH-22.1: Chest Wall Mass**

> Chest x-ray is useful in the workup of a soft-tissue mass and are almost always indicated as the initial imaging study.\(^1\)
> - Chest ultrasound (CPT® 76604) may be useful as an initial imaging study in the setting of a suspected superficial or subcutaneous lipoma. This modality may also be valuable in differentiating cystic from solid lesions and has also been used to assess the vascularity of lesions.\(^1\)
> - CT Chest with contrast (CPT® 71260) or CT Chest without contrast (CPT® 71250) or MRI chest without and with contrast (CPT® 71552) or MRI chest without contrast (CPT® 71550) unless chest x-ray or ultrasound demonstrate ONE of the following:\(^1,2\)
>   - Obvious lipomas\(^1\) (See **MS-10: Soft Tissue Mass or Lesion of Bone**).
>   - Clearly benign entity\(^1\) (See **MS-10: Soft Tissue Mass or Lesion of Bone**).

**Background and Supporting Information**

> Chest x-rays of chest wall masses can detect calcification, ossification, or bone destruction as well as location and size.\(^3\)

**References**

CH-23.1: Pectus Excavatum and Carinatum

- CT Chest without contrast (CPT® 71250) or MRI chest without and with contrast (CPT® 71552) and 3-D reconstruction (CPT® 76377) if:
  - Candidate for surgical correction.\(^1\),\(^2\)
  - Cardiac or pulmonary dysfunction has been identified\(^1\),\(^2\)
    - ECG and echocardiography if cardiac symptoms or evidence of cardiac function abnormalities.
    - Chest x-ray and PFT's if increasing shortness of breath.\(^1\)
  - See PEDCH-11: Pectus Deformities in the Pediatric Chest Imaging Guidelines

Background and Supporting Information

- Chest measurements derived from CT Chest, such as the Haller Index, are helpful to the thoracic surgeon in pre-operative assessment of chest wall deformities to assess for the appropriateness of operative repair prior to the development of symptomatic pectus deformities.

References

CH-24.1: Pulmonary AVM

CT Chest with contrast, CTA Chest (preferred modality) (CPT® 71275), or chest MRA (CPT® 71555) for evaluation of:\(^1,2,3\)
- Suspected pulmonary AVM.
- First degree relatives of an individual with a primary pulmonary AVM.
- Evaluation of individuals with paradoxical embolus/stroke and no evidence of patent foramen ovale on echocardiogram.

**Background and Supporting Information**

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.

**References**

CH-25.1: Pulmonary Embolism

CT Chest with contrast with PE protocol (CPT® 71260) or CTA Chest (CPT® 71275) would be if at least one symptom, clinical/laboratory finding or risk factor from each of the lists below are present.

- With any ONE of the 3: 6,7,8
  - Dyspnea, new onset and otherwise unexplained;
  - Chest Pain, pleuritic;
  - Tachypnea
- AND, with any ONE of the 3: 6,7,8
  - Abnormal D-dimer test;
  - Wells Criteria score* higher than 4 points;
  - One Risk Factor** or Symptom** of new onset demonstrating high clinical probability of PE

<table>
<thead>
<tr>
<th>RISK FACTORS** 6,7,8</th>
<th>SYMPTOMS ATTRIBUTED TO PE** 6,7,8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immobilization at least 3 days or surgery in last 4 weeks or recent trauma</td>
<td>Signs or symptoms of DVT</td>
</tr>
<tr>
<td>Previous history of DVT or PE</td>
<td>Hemoptysis</td>
</tr>
<tr>
<td>Cancer actively treated in last 6 months or receiving palliative treatment</td>
<td>Right heart strain or failure</td>
</tr>
<tr>
<td>Recent history of a long airplane flight</td>
<td>Systolic BP&lt;90</td>
</tr>
<tr>
<td>Use of estrogen-based contraceptives (birth control pills, the patch, and vaginal ring)/Oral estrogen (1)</td>
<td>Syncope</td>
</tr>
<tr>
<td>Advanced age (&gt;70)</td>
<td>Cough</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>Heart Rate &gt;100</td>
</tr>
<tr>
<td>Obesity (BMI &gt;35)</td>
<td>Palpitations</td>
</tr>
</tbody>
</table>
### Well’s Criteria for Clinical Probability of PE*

<table>
<thead>
<tr>
<th>Clinical sign/symptom</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical signs/symptoms of DVT (at minimum: leg swelling and pain with palpation of the deep veins)</td>
<td>3</td>
</tr>
<tr>
<td>PE is likely or equally likely diagnosis</td>
<td>3</td>
</tr>
<tr>
<td>Heart rate &gt;100</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization at least 3 days or surgery in last 4 weeks</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous history of DVT or PE</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1</td>
</tr>
<tr>
<td>Cancer actively treated in last 6 months or receiving palliative treatment</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Calculate Probability:
- Low <2
- Moderate 2 to 6
- High >6

Using the above criteria, only 3% of individuals 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; CTA Chest (CPT® 71275) or MRA chest (CPT® 71555) can be performed if V/Q scanning is not available.
- Ventilation-perfusion scans, also called V/Q, 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
  - Can be considered in any of the following:
    - Suspected pulmonary embolism if there is a contraindication to CT or CTA 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 Individuals with Known PE is not warranted:
- CT Chest with contrast with PE protocol (CPT® 71260) or CTA Chest (CPT® 71275) 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.

Background and Supporting Information

- 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.
References
CH-26: Pulmonary Hypertension

- See PVD-5: Pulmonary Artery Hypertension in the Peripheral Vascular Disease Imaging Guidelines.
**CH-27: Subclavian Steal Syndrome – General**

- 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-27.1 Subclavian Steal Syndrome**

- Initial evaluation should include clinical findings satisfying the symptom complex and initial imaging with carotid duplex study (CPT® 93882).
  - 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.

- MRA Neck and Chest (CPT® 70548 and CPT® 71555) or CTA (CPT® 70498 and CPT® 71275) can be performed for diagnosis in individuals 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 individuals if needed to exclude pathology distal to the subclavian artery and if they will substitute for invasive angiography.


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

- While MRA does not expose the individual to radiation, CTA should be considered the test of choice for subclavian steal syndrome given its superior spatial and temporal resolution.

- 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.

**References**


CH-28: Superior Vena Cava (SVC) Syndrome

CH-28.1: SVC Syndrome
CH-28.1 SVC Syndrome

- CT Chest with contrast (CPT® 71260) for the evaluation of suspected SVC syndrome based on the facial cyanosis and UE swelling without anasarca.\(^1,2\)
- MRV (CPT® 71555) or CTV (CPT® 71275) chest may be indicated when stenting of the SVC is being considered.\(^1,2\)

**Background and Supporting Information**

- 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.

**References**

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<td>76</td>
</tr>
</tbody>
</table>
\textbf{CH-29: Thoracic Aorta}

> Thoracic imaging in this section can be \textbf{ONE} of the following studies listed in the table below:

<table>
<thead>
<tr>
<th>Table of Thoracic Aorta Imaging Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT Chest, and/or Abdomen, and/or Pelvis (CPT® 71260, CPT® 74177, CPT® 74160, CPT® 72193);</td>
</tr>
<tr>
<td>CTA Chest, and/or Abdomen, and/or Pelvis (CPT® 71275, CPT® 74175, CPT® 72191, CPT® 74174);</td>
</tr>
<tr>
<td>MRA Chest, and/or Abdomen, and/or Pelvis (CPT® 71555, CPT® 74185, CPT® 72198)</td>
</tr>
</tbody>
</table>

\textit{Background and Supporting Information}

Thoracic aortic diseases are variable and critical; selected imaging procedures are dependent upon the physicians' preference and expertise.

\textbf{CH-29.1: Aortic Dissection}

> CTA or MRA of the entire aorta (including arch branches) and extending through the femoral arteries for suspected aortic dissection.\textsuperscript{1,2,3,4,5}

> For follow-up, any requested imaging from the “Table of Thoracic Aorta Imaging Options” can be performed.\textsuperscript{1,2,3,4,5,7,9}

\quad “Medically” treated (usually type B) individuals.
  \quad \quad Every 6 months if total aortic diameter is \(\geq 4.5\) cm.
  \quad \quad Annually if total aortic diameter is \(< 4.5\) cm.

\quad Surgery or Stent treatment for any type dissection (A or B).
  \quad \quad First Year: 1 month, 3 months, 6 months, 12 months, then annually.

\textit{Background and Supporting Information}

> 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. Chest x-ray is imprecise; any suspicion should be considered since up to 10\% of individuals with aortic dissection present without classic symptoms.

> CTA is the test of choice given its superior spatial resolution, ease of monitoring the individual in the CT scanner, availability and speed of imaging. MRI can be performed as well but has limitations.
CH-29.2: 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. \(^{1,2,3,4,5}\)

- For known TAA and chest pain or back pain, any requested imaging from the “Table of Thoracic Aorta Imaging Options” above. \(^{1,2,3,4,5}\)

- For planning for pre–thoracic endovascular repair (TEVAR) of thoracic aorta disease. \(^9\)
  - CTA Chest, and/or Abdomen, and/or Pelvis (CPT\textsuperscript{®} 71275, CPT\textsuperscript{®} 74175, CPT\textsuperscript{®} 72191) or
  - MRA Chest, and/or Abdomen, and/or Pelvis (CPT\textsuperscript{®} 71555, CPT\textsuperscript{®} 74185, CPT\textsuperscript{®} 72198)

- For follow-up, any requested imaging from the “Table of Thoracic Aorta Imaging Options” above for the following: \(^4,5,7,9\)
  - “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 treatment.
    - Preoperative open or endovascular (stent) repair imaging is appropriate.
    - Suspicion of endoleaks.
    - 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 PVD-6.2: Abdominal Aortic Aneurysm (AAA).\(^\)
  - 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 Background and Supporting Information.
**CH-29.3: 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 individuals 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 Background and Supporting Information.

**CH-29.4: Thoracic Aorta in Individuals with Bicuspid Aortic Valve**

- **Screening for Bicuspid Aortic Valve.**
  - Screening, 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 individuals 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. See CH-29.2: Thoracic Aortic Aneurysm (TAA)

For more educational information on the Bicuspid Aortic Valve, See Background and Supporting Information

For Coarctation; See PEDPVD-4.1: Thoracic Aortic Disease, PEDAB-14: Renovascular Hypertension and Other Secondary Causes of Hypertension, PEDCD-2.3: Congenital Heart Disease Modality Considerations, PEDCD-2.4: Congenital Heart Disease Timing Considerations
CH-29.5: Calcified Ascending Aorta

Prior to open-heart operations.\textsuperscript{11,12,13}
- Transesophageal echocardiography (TEE), Intraoperative ultrasonography and/or open direct aortic palpation are used to detect atherosclerotic changes in the aortic wall.\textsuperscript{10,11}

Prior to TAVR/I (Transcatheter Aortic Valve Replacement/Implantation)\textsuperscript{3}
- See CT and CTA in CD-4.8: Transcatheter Aortic Valve Replacement (TAVR).

**Background and Supporting Information: Aortic Dissection**

- There are two general types of aortic dissection:
  - **Type A**: Those that begin in the ascending aorta.
  - **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.\textsuperscript{4,5}
  - 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 individuals with bicuspid aortic valve should have both the aortic root and ascending thoracic aorta evaluated for evidence of aortic dilatation.

References
CH-30.1: Elevated Hemidiaphragm

- CT Chest with contrast (CPT® 71260) and CT Neck with contrast (CPT® 70491) (if requested) with new diaphragmatic paralysis after.¹²
  - Previous chest x-rays are available and reviewed to determine if the diaphragmatic elevation is a new finding, 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 CT Chest is negative.¹²
- Repeat advanced imaging studies in the absence of new signs or symptoms are not indicated.

Background and Supporting Information

- 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
CH-31: Thoracic Outlet Syndrome (TOS)

CH-31.1: Thoracic Outlet Syndrome
CH-31.1: Thoracic Outlet Syndrome

- Chest X-ray should be performed initially in all cases, after the onset of symptoms or if there has been a change in symptoms, since it can identify boney abnormalities or other causes of right upper extremity pain.\(^1,2\)
- MR imaging is the preferred imaging modality in individuals with suspected TOS.\(^1,2\)
  - MRI Chest (CPT\textsuperscript{®} 71550) or MRI Upper Extremity Other than Joint (CPT\textsuperscript{®} 73218).
  - MRA Neck and Chest (CPT\textsuperscript{®} 70548 and CPT\textsuperscript{®} 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 for:
    - Suspected anomalous ribs or fractures, as bone anatomy is more easily definable with CT.
    - Postoperative individuals in whom there is a question regarding a remnant first rib.
    - Dialysis-dependent renal failure, claustrophobia, or implanted device incompatibility.
- See PN-4: Brachial Plexus in the Peripheral Nerve Disorders Guidelines.

Background and Supporting Information

- 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 causes seen in 80%, venous causes (also called effort thrombosis) found in 15% and the remaining 5% being arterial in etiology.
- 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.

References

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</table>
CH-32.1: Virtual Bronchoscopy

- There is insufficient data currently available to generate appropriateness criteria for the use of virtual bronchoscopy, and this procedure should be considered investigational at this time.¹
- 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.¹

CH-32.2: Navigational/EM– Guided Peripheral Bronchoscopy

- Peripheral bronchoscopy technology uses electromagnetic (EM) navigational guidance with a CT road map for performing biopsies of peripheral lung lesions.²
  - Supplemental imaging See Preface-4.3: Unlisted Procedures/Therapy Treatment Planning.

References

CH-33.1: 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:
  - CT Chest with and without contrast (CPT® 71270), CT Chest with (CPT® 71260), or CT Chest 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 Test.
- CT Chest with and without contrast (CPT® 71270), CT Chest with (CPT® 71260), or CT Chest without contrast (CPT® 71250) for initial post-transplant follow-up:
  - Requests for subsequent follow-up imaging will go to Medical Director review.

- See CD-1.6: Transplant Individuals.

Reference
### CH-34: Lung Cancer Screening

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<td>CH-34.3: Incidental Pulmonary Nodules Detected on Low Dose CT Chest</td>
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<tr>
<td>(LDCT) Images</td>
<td></td>
</tr>
</tbody>
</table>
**CH-34.1: U.S. Preventative Services Task Force: Lung Cancer Screening (Commercial and Medicaid)**

- Low-dose CT Chest (CPT® G0297) may be approved for lung cancer screening if all of the following criteria are met:

<table>
<thead>
<tr>
<th>Screening Indications – Commercial and Medicaid</th>
<th>Imaging Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ All criteria below must be met for approval:</td>
<td>Low-Dose CT Chest</td>
</tr>
<tr>
<td>➤ Individual has not received a low-dose CT lung</td>
<td>without contrast CPT®</td>
</tr>
<tr>
<td>screening in less than 12 months; and</td>
<td>G0297</td>
</tr>
<tr>
<td>➤ Individual has NO health problems that</td>
<td></td>
</tr>
<tr>
<td>substantially limit life expectancy or</td>
<td></td>
</tr>
<tr>
<td>the ability or willingness to have</td>
<td></td>
</tr>
<tr>
<td>curative lung surgery*; and</td>
<td></td>
</tr>
<tr>
<td>➤ Individual is between 55 and 80 years of age;</td>
<td></td>
</tr>
<tr>
<td>and</td>
<td></td>
</tr>
<tr>
<td>➤ Individual has at least a 30 pack-year history</td>
<td></td>
</tr>
<tr>
<td>of cigarette smoking; and</td>
<td></td>
</tr>
<tr>
<td>➤ Currently smokes or quit within the past (&lt;=)</td>
<td></td>
</tr>
<tr>
<td>15 years</td>
<td></td>
</tr>
</tbody>
</table>

*This is based on a range of chest or other organ signs, symptoms or conditions which would question the member’s ability to undergo surgical or non-surgical treatment if a lung cancer was discovered. For example, congestive heart failure, advanced cancer from another site or a member with COPD who uses oxygen when ambulating, would be examples of conditions that would “substantially limit life expectancy.” Conversely, stable COPD and its symptoms, including cough, shortness of breath would not “substantially limit life expectancy.”

**CH-34.2: This section intentionally left blank**
CH-34.3: Pulmonary Nodules Detected on Low Dose CT Chest (LDCT) Images

For lung nodules, including incidental findings from studies other than screening LDCT, see CH-16.2: Incidental Pulmonary Nodules Detected on CT Images.

Additional intervening diagnostic LDCT, CT Chest (CPT® 72150) or PET/CT (CPT® 78815) can be approved based on the Lung-RADS Version-1.0 designation 3, 4A, 4B or 4X, as indicated in the chart below:

<table>
<thead>
<tr>
<th>Primary Category/Category Descriptor*</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>3: Probably benign finding(s) - short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer</td>
<td>6 month LDCT with a return to annual LDCT screening if unchanged.</td>
</tr>
<tr>
<td>4A: Suspicious - Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>PET/CT may be used when there is a ≥ 8 mm solid component. Follow-up with LDCT in 3 months with another LDCT in 6 months and a return to annual screening if stable and there is low suspicion of lung cancer.</td>
</tr>
<tr>
<td>4B or 4X: Suspicious - Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>CT Chest with or without contrast, PET/CT and/or tissue sampling depending on the probability of malignancy and comorbidities. PET/CT may be used when there is a ≥ 8 mm solid component. If there is low suspicion of lung cancer, follow-up with LDCT in 3 months with another LDCT in 6 months and a return to annual screening if stable.</td>
</tr>
</tbody>
</table>

Category 3 nodules that are unchanged on interval CT should be coded as category 2, Benign Appearance or Behavior, and individuals returned to screening in 12 months.

For example, if the first LDCT was done January 1st and designated Lung-RADS 3 with an interval LDCT done on July 1st – the LDCT annual screening would resume January 1st of the following year.

Category 4A, 4B and 4X is intended to direct the individual out of screening and into a diagnosis based on findings such as a larger, growing or increasingly suspicious nodule.

- If there is a high suspicion of lung cancer with these follow-up CT and/or PET/CT studies, biopsy or surgical excision should be considered.
- If there is a low suspicion of lung cancer with these follow-up CT and/or PET/CT studies, a LDCT should be performed in 3 months and 6 months with a return to annual LDCT screening if unchanged.
<table>
<thead>
<tr>
<th>Category</th>
<th>Category Descriptor</th>
<th>Findings</th>
<th>Management</th>
<th>Probability of Malignancy</th>
<th>Estimated Population Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete</td>
<td>-</td>
<td>0</td>
<td>prior CT Chest examination(s) being located for comparison</td>
<td>Additional lung cancer screening CT images and/or comparison to prior CT Chest examinations is needed</td>
<td>n/a</td>
</tr>
<tr>
<td>Negative</td>
<td>No nodules and definitely benign nodules</td>
<td>1</td>
<td>no lung nodules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign Appearance or Behavior</td>
<td>Nodules with a very low likelihood of becoming a clinically active cancer due to size or lack of growth</td>
<td>2</td>
<td>solid nodule(s): &lt; 6 mm new &lt; 4 mm</td>
<td>Continue annual screening with LDCT in 12 months</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>part solid nodule(s): &lt; 6 mm total diameter on baseline screening</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>non solid nodule(s) (GGN): &lt; 20 mm OR ≥ 20 mm and unchanged or slowly growing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>category 3 or 4 nodules unchanged for ≥ 3 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probably Benign</td>
<td>Probably benign finding(s) - short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer</td>
<td>3</td>
<td>solid nodule(s): ≥ 6 to &lt; 8 mm at baseline OR new 4 mm to &lt; 6 mm</td>
<td>6 month LDCT</td>
<td>1-2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>part solid nodule(s): ≥ 6 mm total diameter with solid component &lt; 6 mm OR new &lt; 6 mm total diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>non solid nodule(s) (GGN) ≥ 20 mm on baseline CT or new</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>4A</td>
<td>4B</td>
<td>4X</td>
<td></td>
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<td>----------</td>
<td>---------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Suspicious</td>
<td>solid nodule(s): ≥ 8 to &lt; 15 mm at baseline OR growing &lt; 8 mm OR new 6 to &lt; 8 mm</td>
<td>part solid nodule(s): ≥ 6 mm with solid component ≥ 6 mm to &lt; 8 mm OR with a new or growing &lt; 4 mm solid component</td>
<td>solid nodule(s) ≥ 15 mm OR new or growing, and ≥ 8 mm</td>
<td>Category 3 or 4 nodules with additional features or imaging findings that increases the suspicion of malignancy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>endobronchial nodule</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>CT Chest with or without contrast, PET/CT and/or tissue sampling depending on the *probability of malignancy and comorbidities. PET/CT may be used when there is a ≥ 8 mm solid component.</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Other</td>
<td>Clinically Significant or Potentially Clinically Significant Findings (non-lung cancer)</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>modifier - may add on to category 0-4 coding</td>
<td></td>
<td>As appropriate to the specific finding</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Prior Lung Cancer</td>
<td>Modifier for individuals with a prior diagnosis of lung cancer who return to screening</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>modifier - may add on to category 0-4 coding</td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Background and Supporting Information**

*The full description of the LUNG-RADS categories [https://www.acr.org/-/media/ACR/Files/RADS/Lung-RADS/LungRADS_AssessmentCategories.pdf](https://www.acr.org/-/media/ACR/Files/RADS/Lung-RADS/LungRADS_AssessmentCategories.pdf)*
References