

CIGNA MEDICAL COVERAGE POLICIES – RADIOLOGY

Chest Imaging Guidelines

Effective Date: February 3, 2026



Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

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

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by EviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

These guidelines include procedures EviCore does not review for Cigna. Please refer to the [Cigna CPT code list](#) for the current list of high-tech imaging procedures that EviCore reviews for Cigna.

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General Guidelines (CH-1)

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Abbreviations for Chest Guidelines

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Abbreviations for Chest Guidelines	
AAA	abdominal aortic aneurysm
ACE	angiotensin-converting enzyme
AVM	arteriovenous malformation
BP	blood pressure
CAD	computer-aided detection
CBC	complete blood count
COPD	chronic obstructive pulmonary disease
CT	computed tomography
CTA	computed tomography angiography
CTV	computed tomography venography
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

Abbreviations for Chest Guidelines	
GI	gastrointestinal
HRCT	high resolution computed tomography
IPF	idiopathic pulmonary fibrosis
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
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

General Guidelines (CH-1.0)

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- A pertinent clinical evaluation since the onset or change in symptoms is required prior to considering advanced imaging.
 - A pertinent clinical evaluation should include the following:
 - a detailed history and physical examination
 - appropriate laboratory studies and basic imaging, such as plain radiography or ultrasound
 - A chest x-ray since the onset or change in symptoms 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.
 - For an established individual a meaningful technological contact (telehealth visit, telephone call, electronic mail or messaging) since the onset or change in symptoms can serve as a pertinent clinical evaluation.

Health Equity Considerations

Health equity is the highest level of health for all individuals; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which individuals are born, grow, live, work, and age. Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include the following: safe housing, transportation, and neighborhoods; racism, discrimination, and violence; education, job opportunities, and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

General Guidelines – Chest X-Ray

(CH-1.1)

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- Chest x-ray can help identify previously unidentified disease and direct proper advanced imaging for such conditions as:
 - mediastinal lymphadenopathy (See **Mediastinal Lymphadenopathy (CH-2.3)**)
 - cough (See **Cough (CH-3.1)**)
 - non-cardiac chest pain (See **Non-Cardiac Chest Pain - Imaging (CH-4.1)**)
 - dyspnea (See **Dyspnea/Shortness of Breath (CH-5.1)**)
 - suspected post endobronchial valve complication (See **Post Endobronchial Valve (EBV) Placement (CH-5.3)**)
 - hemoptysis (See **Hemoptysis (CH-6.1)**)
 - bronchitis (See **Bronchitis (CH-8.1)**)
 - asbestos exposure (See **Asbestos Exposure (CH-9.1)**)
 - chronic obstructive pulmonary disease (See **COPD (CH-10.1)**)
 - e-cigarette or vaping product use-associated lung injury (See **E-cigarette, or Vaping, Product-Use Associated Lung Injury (EVALI) (CH-11.2)**)
 - pleural effusion (See **Pleural Effusion (CH-18.1)**)
 - pneumothorax or hemothorax (See **Pneumothorax/Hemothorax (CH-19.1)**)
 - pneumomediastinum (See **Pneumomediastinum; Subcutaneous Emphysema (CH-19.2)**)
 - fractured ribs, sternum, or clavicle (See **Chest Trauma (CH-21.1)**)
 - chest wall mass (See **Chest Wall Mass (CH-22.1)**)
 - acute and chronic infections (See **Pneumonia and Coronavirus Disease 2019 (COVID-19) (CH-13)** and **Other Chest Infections (CH-14)**)
 - malignancies
- Exceptions to preliminary chest x-ray may include such conditions as:
 - supraclavicular lymphadenopathy (See **Supraclavicular Region (CH-2.1)**)
 - axillary lymphadenopathy (See **Axillary Lymphadenopathy (and Mass) (CH-2.2)**)
 - costochondritis (See **Costochondritis/Other Musculoskeletal Chest Wall Syndrome (CH-4.2)**)
 - pre-operative assessment (See **Pre-Operative Assessment CH-5.2)**)
 - known bronchiectasis (See **Bronchiectasis (CH-7.1)**)
 - cystic fibrosis (See **Adult Cystic Fibrosis (CH-7.2)**)
 - suspected interstitial lung disease (See **Interstitial Lung Disease (ILD)/Diffuse Lung Disease (DLD) (CH-11.1)**)

- positive PPD or tuberculosis (See **Other Chest Infections (CH-14)**)
- sarcoidosis (See **Sarcoid (CH-15.1)**)
- pulmonary nodules (See **Solitary Pulmonary Nodule (SPN) (CH-16)** and **Pleural-Based Nodules and Other Abnormalities (CH-17.1)**)
- mediastinal mass (See **Mediastinal Mass (CH-20.1)**)
- pectus excavatum and carinatum (See **Pectus Excavatum and Carinatum (CH-23.1)**)
- pulmonary arteriovenous fistula (See **Pulmonary AVM (CH-24.1)**)
- pulmonary embolism (See **Pulmonary Embolism (CH-25.1)**)
- elevated hemidiaphragm (See **Elevated Hemidiaphragm (CH-30.1)**)
- pre- or post-lung transplant (See **Lung Transplantation (CH-32)**)
- lung cancer screening (See **Lung Cancer Screening (CH-33)**)

General Guidelines – Chest Ultrasound (CH-1.2)

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- 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. It may be helpful in identifying pleural effusions (See **Pleural Effusion (CH-18)**).
 - Chest ultrasound:
 - CPT® 76604
 - Breast ultrasound:
 - CPT® 76641: unilateral, complete
 - CPT® 76642: unilateral, limited
 - CPT® 76641 and CPT® 76642 be reported only once per breast, per imaging session
 - Axillary ultrasound:
 - CPT® 76882 (unilateral); if bilateral, can be reported as CPT® 76882 x 2

General Guidelines – CT Chest (CH-1.3)

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- Intrathoracic abnormalities as covered in these guidelines found on chest x-ray, fluoroscopy, CT Abdomen, or other imaging modalities can be further evaluated with CT Chest with contrast (CPT® 71260).
- 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)
- For low-dose CT Chest (CPT® 71271 OR CPT® 71250): See **Lung Cancer Screening (CH-33)**.
- 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.

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.
- Low-dose CT chest does not have a specific, separate CPT® code associated with it. It should be reported with the standard CT chest CPT code (CPT® 71250).
 - An exception to this is the low-dose CT used specifically for the annual lung cancer screening scans, for which CPT® 71271 is used.

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

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- CTA Chest (CPT® 71275) is medically necessary for:
 - non-cardiac chest pain (See **Non-Cardiac Chest Pain - Imaging (CH-4.1)**)
 - hemoptysis (See **Hemoptysis (CH-6.1)**)
 - pulmonary arteriovenous fistula (See **Pulmonary AVM (CH-24.1)**)
 - pulmonary embolism (See **Pulmonary Embolism (CH-25.1)**)
 - pre-lung transplantation (See **Pre-Transplant Imaging Studies (CH-32.1)**)
 - prior to minimally invasive or robotic surgery (See **Transcatheter Aortic Valve Replacement (TAVR) (CD-4.8)** in the Cardiac Imaging Guidelines)

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

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- Indications for MRI Chest are infrequent and may relate to concerns about CT contrast such as renal insufficiency or contrast allergy. MRI is medically necessary for:
 - Clarification of equivocal findings on previous imaging studies (often in the thymic mediastinal region).
 - Certain conditions include:
 - mediastinal lymphadenopathy (See **Mediastinal Lymphadenopathy (CH-2.3)**)
 - chest wall mass (See **Chest Wall Mass (CH-22.1)**)
 - mediastinal mass (See **Mediastinal Mass (CH-20.1)**)
 - chest muscle tendon injuries (See **Muscle/Tendon Unit Injuries/Diseases (MS-11.0)** in the Musculoskeletal Imaging Guidelines)
 - pectoralis tendon rupture (See **Muscle/Tendon Unit Injuries/Diseases (MS-11.0)** in the Musculoskeletal Imaging Guidelines)
 - brachial plexopathy (See **Brachial Plexus (PN-4.1)** in the Peripheral Nerve Disorders Imaging Guidelines)
 - thymoma (See **Thymoma and Thymic Carcinoma - Suspected/Diagnosis (ONC-10.5)** in the Oncology Imaging Guidelines)

Navigational Bronchoscopy and Biopsy (CH-1.7)

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- CPT[®] 76497 (Unlisted CT procedure) if:
 - A CT Chest has been performed within the last 6 weeks and study is needed for navigational bronchoscopy.
- CT Chest without contrast (CPT[®] 71250) if:
 - Previous diagnostic scan was ≥ 6 weeks ago and study is needed for navigational bronchoscopy.
- Bronchoscopy with computer-assisted, image-guided navigation, includes three-dimensional reconstruction. Do not report in conjunction with 3-D rendering CPT codes (CPT[®] 76376) or (CPT[®] 76377).
- Core needle biopsy (CPT[®] 32408) for:
 - Biopsy of the lung or mediastinum to diagnose malignancy.
- For robotic-assisted lung resection, see **Pre-Operative Assessment (CH-5.2)**.

Background and Supporting Information

- Navigational bronchoscopy: This is a form of guided bronchoscopy. A special sensor inside a bronchoscopy is used to navigate to the desired location within the lung. Computer software generates a virtual bronchial tree which provides a road map to the target lesion. A thin-cut CT Chest with optimized reconstruction parameters is required to generate the virtual map of the lungs. A previous CT Chest may not be usable for navigation if it was not formatted correctly, even if done just a few days prior.
- Names for navigational bronchoscopy systems can include:
 - superDimension or super-D
 - Spin Thoracic Navigation System
 - Archimedes
 - Monarch Platform - robotic
 - Ion - endoluminal robotic bronchoscopy platform
- The diagnostic accuracy of navigational bronchoscopy is 70.9-79%. It has an excellent safety profile, with an adverse event rate (e.g., pneumothorax) of 3.3-5.6%.
- Cone-Beam CT, (CBCT) is a newer technique that helps locate the nodule in real time. Studies have shown comparable results and diagnostic yields to other guided bronchoscopy strategies. CBCT combined with other navigational techniques often reaches a higher navigational success rate and diagnostic rate. However, a recent

study found no statistically significant differences in diagnostic sensitivity, specificity, and accuracy between those who received CBCT and other methods. Additionally, CBCT can expose the individual and operator to radiation through the repeated acquisition of images. The mean radiation dose was determined to be 48.4 Gy cm² per case; this excessive and unnecessary radiation can cause radioactive damage to the individual and the operator. Another study concluded that, "Additional studies are warranted to confirm the safety and efficacy of this technique". Efforts are required to improve diagnostic accuracy and standardized practices before CBCT can be considered mainstream. Large-scale randomized controlled trials that compare CBCT with other navigational techniques are necessary to determine the most optimal navigational strategy, clinical criteria for CBCT usage, and the best way to diagnose peripheral pulmonary lesions.

References (CH-1)

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1. Raoof S, Feigin D, Sung A, Raoof S, Irugulpati L, Rosenow EC 3rd. Interpretation of plain chest roentgenogram. *Chest*. 2012;141(2):545-558. doi:10.1378/chest.10-1302
2. Eisen LA, Berger JS, Hegde A, Schneider RF. Competency in chest radiography. A comparison of medical students, residents, and fellows. *J Gen Intern Med*. 2006;21(5):460-465. doi:10.1111/j.1525-1497.2006.00427.x
3. Rawson JV, Pelletier AL. When to Order a Contrast-Enhanced CT. *Am Fam Physician*. 2013;88(5):312-316.
4. **RECOMMENDED CT SCAN and RECONSTRUCTION PARAMETERS SUPPLEMENT**. <https://www.medtronic.com/content/dam/covidien/library/us/en/product/interventional-lung-solutions/illumisite-platform-scan-parameters-information-sheet.pdf>
5. Gildea TR, Mazzone PJ, Karnak D, Meziane M, Mehta AC. Electromagnetic navigation diagnostic bronchoscopy: a prospective study. *Am J Respir Crit Care Med*. 2006;174(9):982-989. doi:10.1164/rccm.200603-344OC
6. Mehta AC, Hood KL, Schwarz Y, Solomon SB. The Evolutional History of Electromagnetic Navigation Bronchoscopy: State of the Art. *Chest*. 2018;154(4):935-947. doi:10.1016/j.chest.2018.04.029
7. Piro R, Fontana M, Casalini E, et al. Cone beam CT augmented fluoroscopy allows safe and efficient diagnosis of a difficult lung nodule. *BMC Pulm Med*. 2021;21(1):327. doi:10.1186/s12890-021-01697-y
8. Podder S, Chaudry S, Singh H, Jondall EM, Kurman JS, Benn BS. Efficacy and safety of cone-beam CT augmented electromagnetic navigation guided bronchoscopic biopsies of indeterminate pulmonary nodules. *Tomography*. 2022;8(4):2049-2058. doi:10.3390/tomography8040172.
9. Kops SEP, Heus P, Korevaar DA, et al. Diagnostic yield and safety of navigation bronchoscopy: A systematic review and meta-analysis. *Lung Cancer*. 2023;180:107196. doi:10.1016/j.lungcan.2023.107196
10. Lentz RJ, Frederick-Dyer K, Planz VB, et al. Navigational bronchoscopy or transthoracic needle biopsy for lung nodules. *N Engl J Med*. 2025. doi:10.1056/NEJMoa2414059
11. Yang H, Huang J, Zhang Y, et al. The diagnostic performance and optimal strategy of cone beam CT-assisted bronchoscopy for peripheral pulmonary lesions: A systematic review and meta-analysis. *Pulmonology*. 2025;31(1):2420562. doi:10.1080/25310429.2024.2420562

Lymphadenopathy (CH-2)

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Supraclavicular Region (CH-2.1)

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- Ultrasound (CPT[®] 76536) is the initial study for palpable or suspected lymphadenopathy.
 - Allows simultaneous ultrasound-guided core needle biopsy (CPT[®] 76942)
 - CT Neck with contrast (CPT[®] 70491) or CT Chest with contrast (CPT[®] 71260) if ultrasound is indeterminate
 - See **General Guidelines (Neck-1.0)** in the Neck Imaging Guidelines

Evidence Discussion

For suspected or palpable supraclavicular lymphadenopathy, ultrasound (US) has an excellent sensitivity rate, up to 100% for the detection of metastases. CT Neck had a lower sensitivity rate of 83% for the same lesion.⁶ Ultrasound avoids the ionizing radiation exposure of CT, is readily available, and allows for the use of US-guided fine-needle aspiration cytology for diagnosis.

Axillary Lymphadenopathy (and Mass) (CH-2.2)

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- There is no evidence-based support for advanced imaging of clinically evidenced axillary lymphadenopathy prior to a biopsy. If axillary node biopsy reveals benign findings, advanced imaging is not medically necessary. If axillary node biopsy reveals findings concerning for malignancy, pathology results will determine the need for further advanced imaging. See **Carcinoma of Unknown Primary Site (ONC-31.7)** in the Oncology Imaging Guidelines for imaging recommendations for carcinoma found in an axillary lymph node.
- Localized axillary lymphadenopathy:
 - Axillary US (CPT® 76882)
 - Initial evaluation of any axillary mass or enlarged node
 - Search for adjacent hand or arm injury or infection, and
 - 3-4 week observation if benign clinical picture (for ipsilateral COVID vaccination-related adenopathy, observation for 12 or more weeks is recommended). Follow-up imaging with ultrasound is medically necessary if there is a significant risk of metastatic adenopathy (e.g., breast, head and neck, upper extremity/trunk melanoma or lymphoma)
 - If axillary adenopathy is unchanged, then consider additional follow up 6 months after initial presentation.
 - Ultrasound directed core needle biopsy or surgical excisional biopsy of the most abnormal lymph node if:
 - Condition persists.
 - Malignancy is suspected.
 - Surgical excisional biopsy if core needle biopsy results are non-diagnostic.
 - Advanced imaging is not medically necessary.
- Generalized axillary lymphadenopathy:
 - Axillary US (CPT® 76882)
 - Initial evaluation of any axillary mass or enlarged node
 - Ultrasound directed core needle biopsy or surgical excisional biopsy of the most abnormal lymph node if condition persists, if malignancy is suspected, or surgical excisional biopsy if core needle biopsy results are non-diagnostic.
 - Diagnostic work-up, including serological tests, for systemic diseases
 - Advanced imaging is not medically necessary.
 - See **Non-Hodgkin Lymphomas (ONC-27)** in the Oncology Imaging Guidelines.

- Occult primary cancer in axillary lymph node(s):
 - See **Metastatic Cancer, Carcinoma of Unknown Primary Site, and Other Types of Cancer (ONC-31)** in the Oncology Imaging Guidelines.
- For unexplained axillary lymphadenopathy in individuals with silicone breast implants, see **Breast Implant Evaluation (BR-5.2)**

Evidence Discussion

Initial evaluation of an axillary mass or axillary lymphadenopathy (LAN) should be ultrasound (US). US allows for real-time evaluation and immediate image-directed biopsy.¹¹ CT Chest is usually not appropriate in the evaluation of axillary LAN, especially in the female population with concern for breast cancer.¹⁰

Ultrasound is a very important initial imaging modality which is easy to obtain, universally available and portable, exposes individuals to no radiation, and is cost effective. It is also excellent in helping to determine next best advanced imaging study including appropriate protocol and contrast level. US not only provides excellent soft tissue resolution, but also provides characterization of cystic lesions (Bosniak classification) whether complex or simple to help guide follow up imaging interval or biopsy.

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.
- COVID-19 vaccine-related unilateral axillary adenopathy has been well documented to occur in 12% of recipients after the first dose and up to 16% after the second dose. In some series the incidence has been as high as 53%. Adenopathy usually develops within the first few days after vaccination and lasts a mean of 10 days. However, 29% had lymphadenopathy which persisted >6 weeks. PET-CT can provide false positive results of unilateral axillary adenopathy up to 7-10 weeks post vaccination. Due to these concerns, in individuals with cancer history, it is recommended that the vaccination be provided in the contralateral arm, especially in case of unilateral breast cancer.
- The Society for Breast Imaging (SBI) recommends that for unilateral axillary adenopathy on screening exams who received a recent COVID-19 vaccination in the ipsilateral upper extremity, a follow up interval of 12 or more weeks is recommended. If axillary adenopathy persists after short term follow up, then consider lymph node sampling to exclude breast and non-breast malignancy. Imaging for urgent cancer related clinical indication should not be delayed in relationship to COVID vaccine timing. For routine surveillance, screening and similar non-urgent

indications, postponement of imaging for at least 6 weeks after vaccinations should be considered. However, the SBI no longer recommends delaying screening mammograms around COVID-19 vaccinations.

Mediastinal Lymphadenopathy (CH-2.3)

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- CT Chest with contrast (CPT[®] 71260) if mediastinal abnormalities are detected on a chest x-ray (over read by a radiologist), other non-dedicated advanced chest imaging, or clarification of mediastinal abnormalities on a non-contrast CT Chest.
 - If contrast cannot be tolerated due to allergy or renal dysfunction, MRI chest without and with contrast (CPT[®] 71552) OR MRI chest without contrast (CPT[®] 71550) is medically necessary.
 - Follow-up CT Chest (CPT[®] 71260) after 3-6 months if:
 - enlarged lymph nodes, ≥ 15 mm, are in the mediastinum with no other thoracic abnormalities; and
 - thereafter, stability or decreasing size, further advanced imaging is not medically necessary.
 - Further evaluations:
 - Lymph node biopsy (see methods below) is medically necessary for:
 - persistent or increasing lymphadenopathy on follow-up CT Chest; or
 - suspected malignancy.
 - See **Non-Hodgkin Lymphomas (ONC-27)** and/or **Hodgkin Lymphoma (ONC-28)** in the Oncology Imaging Guidelines for suspicion of Lymphoma.
- PET/CT (CPT[®] 78815) is medically necessary for enlarged lymph nodes, ≥ 15 mm with no explainable disease or increasing lymph node size on follow-up CT Chest

Evidence Discussion

- CT Chest is medically necessary for mediastinal abnormalities detected on chest x-ray or other non-dedicated advanced imaging. CT allows for further tissue characterization and can distinguish between calcium, macroscopic fat and water attenuation fluid.¹ CT has higher contrast resolution than plain chest radiography. CT does carry with it the risk of both iodinated contrast exposure and ionizing radiation exposure.
- Asymptomatic, incidental mediastinal lymph nodes less than 15mm (in the short axis) do not require follow up. Evison et al found that size was the greatest predictor of lymph node etiology with those less than 15mm always found to be reactive.⁸
- For mediastinal lymph nodes greater than or equal to 15mm, follow-up should be directed by suspected etiology. For those with low or no clinical suspicion for malignancy and no other thoracic abnormalities, follow up CT chest in 3-6 months is medically necessary.⁸ If the lymph nodes have increased in size on follow-up imaging, PET/CT or tissue biopsy is medically necessary.⁸

- For those with no explainable disease and mediastinal lymph nodes greater than or equal to 15mm, PET/CT is medically necessary. However, PET/CT has well-documented false positive results in this setting given the overlap of increased FDG uptake in both oncologic and infection or inflammatory disease processes.⁸

Background and Supporting Information

- Incidentally detected lymph nodes <15mm (in short axis) in individuals with no other findings do not require further evaluation.
- Most benign nodes have smooth and well-defined borders, show uniform and homogeneous attenuation, and demonstrate a central fatty hilum.
- Explainable disease such as emphysema, interstitial lung disease, sarcoidosis, cardiac disease.
- Unexplained causes, consider lymphoma, undiagnosed metastatic disease, including testicular carcinoma in young male, and infection.
- 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-2)

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1. Mehta N, Sales RM, Babagbemi K, et al. Unilateral axillary Adenopathy in the setting of COVID-19 vaccine. *Clin Imaging*. 2021;75:12-15. doi:10.1016/j.clinimag.2021.01.016.
2. Eifer M, Tau N, Alhoubani Y, et al. COVID-19 mRNA Vaccination: Age and Immune Status and Its Association with Axillary Lymph Node PET/CT Uptake. *J Nucl Med*. 2022;63(1):134-139. doi:10.2967/jnumed.121.262194.
3. Garreffa E, Hamad A, O'Sullivan CC, et al. Regional lymphadenopathy following COVID-19 vaccination: Literature review and considerations for patient management in breast cancer care. *Eur J Cancer*. 2021;159:38-51. doi:10.1016/j.ejca.2021.09.033.
4. Becker AS, Perez-Johnston R, Chikarmane SA, et al. Multidisciplinary Recommendations Regarding Post-Vaccine Adenopathy and Radiologic Imaging: Radiology Scientific Expert Panel. *Radiology*. 2021;300(2):E323-E327. doi:10.1148/radiol.2021210436.
5. 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(1):75-80. doi:10.1148/radiol.2321030663
6. English BS, Ray CE, Chang JY, et al. Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® Radiologic Management of Pulmonary Nodules and Masses. Am Coll Radiol (ACR); Date of Origin: 1996. Revised: 2015. <https://acsearch.acr.org/docs/69343/Narrative/>.
7. Munden RF, Carter BW, Chiles C, et al. Managing Incidental Findings on Thoracic CT: Mediastinal and Cardiovascular Findings. A White Paper of the ACR Incidental Findings Committee. *J Am Coll Radiol*. 2018;15(8):1087-1096. doi:10.1016/j.jacr.2018.04.029.
8. Expert Panel on Thoracic Imaging, Ackman JB, Chung JH, et al. ACR Appropriateness Criteria® Imaging of Mediastinal Masses. *J Am Coll Radiol*. 2021;18(5S):S37-S51. doi:10.1016/j.jacr.2021.01.007.
9. Expert Panel on Breast Imaging, Le-Petross HT, Slanetz PJ, et al. ACR Appropriateness Criteria® Imaging of the Axilla. *J Am Coll Radiol*. 2022;19(5S):S87-S113. doi:10.1016/j.jacr.2022.02.010.
10. Sun SX, Moseley TW, Kuerer HM, Yang WT. Imaging-Based Approach to Axillary Lymph Node Staging and Sentinel Lymph Node Biopsy in Patients With Breast Cancer. *AJR Am J Roentgenol*. 2020;214(2):249-258. doi:10.2214/AJR.19.22022.
11. Patel K, Khan Z, Costumbrado J. To Drain or not to Drain? Point-of-care Ultrasound to Investigate an Axillary Mass: Case Report. *Clin Pract Cases Emerg Med*. 2022;6(2):155-158. doi:10.5811/cpcem.2022.2.53357
12. Co M, Wong PCP, Kwong A. COVID-19 vaccine associated axillary lymphadenopathy - A systematic review. *Cancer Treat Res Commun*. 2022;31:100546. doi:10.1016/j.ctarc.2022.100546
13. Zhang M, Ahn RW, Hayes JC, Seiler SJ, Mootz AR, Porembka JH. Axillary Lymphadenopathy in the COVID-19 Era: What the Radiologist Needs to Know. *Radiographics*. 2022;42(7):1897-1911. doi:10.1148/rg.220045
14. Roy SG, Digumarthy SR. Imaging Evaluation of Mediastinal and Hilar Lymphadenopathy: Approach, Classification, and Differential Diagnosis. *Semin Roentgenology* 2025;00;1-18. doi:10.1053/j.ro.2025.02.007
15. Goldin, J. (2025). Mastering Mediastinal Imaging: Tips, Tricks, and Key Diagnoses. In: Hodler, J., Kubik-Huch, R.A., Roos, J.E. (eds) *Diseases of the Chest, Heart and Vascular System 2025-2028*. IDKD Springer Series. Springer, Cham. doi: 10.1007/978-3-031-83872-9_2
16. Jain, V., Ahuja, J., Strange, C. D., Agrawal, R., Palacio, D. M., Truong, M., & Marom, E. M. (Accepted/In press). Imaging of Mediastinal Masses. *Radiologic Clinics of North America*. <https://doi.org/10.1016/j.rcl.2024.12.006>

Cough (CH-3)

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Cough (CH-3.1)

CH.CH.0003.1.C

v1.0.2026

- Initial evaluation should include a chest x-ray after the current episode of cough started or changed.
 - In addition all medications known to cause coughing (e.g., ACE inhibitors, Sitagliptin) should be discontinued.
- 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:
 - Antihistamine and decongestant or intranasal glucocorticoid treatment.
 - Spirometry and/or pulmonary function tests (PFT's).
 - Empiric trial of corticosteroids (oral or inhaled) and/or leukotriene receptor antagonist (e.g., Montelukast).
 - Treatment of gastroesophageal reflux disease (GERD).
 - See **Sinus and Facial Imaging (HD-29.1)** in the Head Imaging Guidelines.
 - Current or past cigarette smokers with either:
 - new cough lasting greater than 2 weeks.
 - changed chronic cough in worsening frequency or character
 - See **Hemoptysis (CH-6.1)**
 - See the relevant Chest Imaging Guideline section for advanced chest imaging to evaluate any abnormalities present on the initial chest x-ray
 - For individuals with high suspicion for lung cancer despite normal chest x-ray:
 - See Non-Small Cell Lung Cancer Suspected/Diagnosis (ONC-8.2)
- CT Maxillofacial without contrast (CPT[®] 70486) or CT Sinus, limited without contrast (CPT[®] 76380) is medically necessary in those with suspicion of Upper Airway Cough Syndrome (UACS) in the following:
 - Clinical criteria for chronic rhinosinusitis (CRS) or acute/recurrent rhinosinusitis are met, as per **Sinus and Facial Imaging (HD 29.1)**; **OR** ALL of the following:
 - at least a one week trial of daily antihistamine/decongestant
 - initial evaluation with a chest x-ray and/or CT Chest after the current episode of cough started or changed
 - all medications known to cause cough have been discontinued

Evidence Discussion

CT chest is not recommended routinely in people with a chronic cough, normal chest xray, and normal physical exam. There is concern regarding potential cancer risk from CT radiation exposure, especially in women and children.⁷ For individuals with cough of unknown etiology or a chronic cough refractory to therapy, a CT chest may identify changes not seen on chest x-ray, such as interstitial lung disease or bronchiectasis.^{7,9,12}

Current or former smokers with a new cough or change in chronic cough do not need a trial of therapy for UACS, asthma or GERD prior to a chest CT if an initial chest x-ray is abnormal or non-diagnostic.³

CT maxillofacial may be considered for suspected chronic rhinosinusitis (CRS) as the cause of chronic cough after clinical examination and chest x-ray if there is no response to empiric therapy or if the history and nasal endoscopy findings are concerning for CRS.^{3,5,9}

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. Smoking cessation is “almost always effective” in resolving cough in smoker.
- Cough after URI (Upper Respiratory Infection) can typically last beyond 2-3 weeks.
- Objective evidence of classic asthmatic cough conventionally requires some evidence of variable airflow obstruction such as peak flow variability, or reversibility to bronchodilator of >12%-15%.
- In adults with chronic cough suspected to be due to reflux-cough syndrome, it is recommended that treatment include (1) diet modification to promote weight loss in overweight or obese individuals; (2) head of bed elevation and avoiding meals within 3 hours of bedtime; and (3) in individuals who report heartburn or regurgitation, PPI's, H-2 receptor antagonists, alginate or antacid therapy sufficient to control these symptoms.
- When cough remains refractory to treatment, high-resolution CT scanning of the thorax is recommended to rule out parenchymal lung disease that is not visible on plain chest x-ray.

Cough Health Equity Considerations

Health Equity Considerations for Cough

- Chronic cough is more prevalent in older adults. Younger adults with chronic cough are more likely to be men, and older adults are more likely to be women.

References (CH-3)

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1. Gibson P, Wang G, McGarvey L, et al. Treatment of Unexplained Chronic Cough: CHEST Guideline and Expert Panel Report. *Chest*. 2016;149(1):27-44. doi:10.1378/chest.15-1496.
2. Pratter MR, Brightling CE, Boulet LP, Irwin RS. 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.
3. Irwin RS, French CL, Chang AB, Altman KW; CHEST Expert Cough Panel*. Classification of Cough as a Symptom in Adults and Management Algorithms: CHEST Guideline and Expert Panel Report. *Chest*. 2018;153(1):196-209. doi:10.1016/j.chest.2017.10.016.
4. Pratter MR. Chronic upper airway cough syndrome secondary to rhinosinus diseases (previously referred to as postnasal drip syndrome): ACCP evidence-based clinical practice guidelines. *Chest*. 2006;129(1 Suppl):63S-71S. doi:10.1378/chest.129.1_suppl.63S.
5. Donaldson AM. Upper Airway Cough Syndrome. *Otolaryngol Clin North Am*. 2023;56(1):147-155. doi:10.1016/j.otc.2022.09.011.
6. Dykewicz MS, Wallace DV, Amrol DJ, et al. Rhinitis 2020: A practice parameter update. *J Allergy Clin Immunol*. 2020;146(4):721-767. doi:10.1016/j.jaci.2020.07.007.
7. Morice AH, Millqvist E, Bieksiene K, et al. ERS guidelines on the diagnosis and treatment of chronic cough in adults and children [published correction appears in *Eur Respir J*. 2020 Nov 19;56(5):]. *Eur Respir J*. 2020;55(1):1901136. Published 2020 Jan 2. doi:10.1183/13993003.01136-2019.
8. Kahrilas PJ, Altman KW, Chang AB, et al. Chronic Cough Due to Gastroesophageal Reflux in Adults: CHEST Guideline and Expert Panel Report. *Chest*. 2016;150(6):1341-1360. doi:10.1016/j.chest.2016.08.1458.
9. Expert Panel on Thoracic Imaging, Kuzniowski CT, Kizhner O, et al. ACR Appropriateness Criteria® Chronic Cough. *J Am Coll Radiol*. 2021;18(11S):S305-S319. doi:10.1016/j.jacr.2021.08.007.
10. Spanevello A, Beghé B, Visca D, Fabbri LM, Papi A. Chronic cough in adults. *Eur J Intern Med*. 2020;78:8-16. doi:10.1016/j.ejim.2020.03.018
11. Irwin RS, Madison JM. Unexplained or Refractory Chronic Cough in Adults. *N Engl J Med*. 2025;392(12):1203-1214. doi:10.1056/NEJMra2309906
12. Truba O, Dabrowska M, Grabczak EM, et al. Diagnostic yield of chest radiograph in management of adults with difficult-to-treat chronic cough-retrospective study. *J Thorac Dis*. 2023;15(2):928-939. doi:10.21037/jtd-22-111
13. Sonoda K, Nayak R. Chronic Cough: Evaluation and Management. *Am Fam Physician*. 2024;110(2):167-173.
14. Kang J, Seo WJ, Kim JG, et al. Sex-related disparities in cough-associated symptoms across different age groups. *Ther Adv Respir Dis*. 2024;18:17534666241252545. doi:10.1177/17534666241252545

Non-Cardiac Chest Pain (CH-4)

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Non-Cardiac Chest Pain – Imaging (CH-4.1)

CH.CP.0004.1.A

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- Initial evaluation should include a chest x-ray.
 - CT Chest with contrast (CPT[®] 71260) or CTA Chest (CPT[®] 71275) if x-ray is abnormal. See **Pneumonia (CH-13.1)**
- Sub-Sternal Non-Cardiac Chest Pain:
 - If x-ray is normal and the chest pain is substernal, the individual should undergo evaluation of other possible causes of pain prior to advanced imaging (CT Chest with contrast or CTA Chest) including:
 - Cardiac evaluation (See General Guidelines (CD-1) in the Cardiac Imaging Guidelines)
 - GI treatment with any ONE of the following:
 - Trial of anti-reflux medication, or pH probe, or esophageal manometry or
 - Barium swallow or endoscopy
 - Pulmonary Function Test (PFT's) in those with known or suspected respiratory disease
 - CT Chest with contrast (CPT[®] 71260) if persistent:
 - The initial chest x-ray reveals no abnormalities with known Sickle cell disease
- Non-Cardiac Chest Pain, other than Sub-Sternal:
 - If x-ray is normal and the chest pain is in a location other than substernal:
 - CT Chest with (CPT[®] 71260) or without (CPT[®] 71250) contrast and/or bone scan for:
 - known or suspected malignancy, including individuals with chest pain associated with cough and weight loss
 - CT Chest with (CPT[®] 71260) or without (CPT[®] 71250) contrast for:
 - suspected infectious or inflammatory condition
 - history of prior chest intervention (surgery, Radiation Therapy)
 - MRI Chest without and with contrast (CPT[®] 71552) for:
 - necrotizing fasciitis
 - surgical planning prior to debridement procedure
 - For suspected migration of implantable contraceptive devices, see Implantable Contraceptive Devices (PV-10.3)

Evidence Discussion

It is important to rule out potentially life-threatening causes of acute chest pain, such as an acute coronary syndrome, aortic dissection, and pulmonary embolus. These topics are discussed in other guideline summaries (CD 1.0, CD 1.4, PVD 6.2 and PVD 6.3, CH 25.1). A specialized imaging protocol called the "triple rule-out" is sometimes used to evaluate the pulmonary arteries, aorta and coronary arteries. However, it is associated with higher non-diagnostic imaging quality, radiation and contrast doses.⁸ The population for which it may be useful is unknown. It is yet to be proven useful in large clinical trials, and its appropriate use needs to be further defined.^{8,9,10}

An evaluation for the cause of non-cardiac "angina-like" chest pain should be done if it persists or recurs despite a negative stress test or anatomic cardiac evaluation, or a low risk designation by a clinical decision pathway.¹¹ The differential diagnosis of non-cardiac chest pain is broad. The most common causes in a primary care setting are chest wall pain, reflux esophagitis, and costochondritis.⁶ Respiratory causes include pneumonia, pleuritis, and pneumothorax. People with COPD or acute asthma exacerbations may experience chest pain.^{5,12} A thorough history and physical exam are important to help narrow the differential diagnosis and direct imaging. Musculoskeletal causes are usually diagnosed based on history and physical exam (point tenderness, reproducibility with palpation) without the need for diagnostic imaging. Most individuals should have an ECG and chest x-ray (CR).¹¹ CR is rapid, non-invasive and is medically necessary in the initial evaluation of acute non-specific chest pain with a low probability of coronary artery disease (CAD).^{1,11} In individuals without evidence of cardiac or pulmonary disease, evaluation for a GI cause is reasonable. An empiric trial of acid suppression may be merited. If this is ineffective or there are alarm symptoms, an EGD, pH probe and/or motility study should be considered.^{11,13,14}

Individuals with sickle cell disease and acute chest pain should have a CR initially.¹¹ Acute chest syndrome is defined by a new infiltrate on CR with fever and/or respiratory symptoms. In the presence of unexplained hypoxemia and an unremarkable CR, CT chest may be obtained to evaluate the pulmonary vasculature and lung parenchyma.¹⁵

CR is medically necessary for non-traumatic chest wall pain and no history of malignancy to evaluate for a specific etiology, such as rib fracture, pneumonia, or pneumothorax.^{4,17} Following a normal CR, CT chest is medically necessary to evaluate chest pain in the setting of known or suspected malignancy, suspected infectious or inflammatory condition, or a history of prior chest intervention.⁴ CT is more sensitive than CR for characterizing chest wall neoplasms, chest wall infections, and subtle osseous and soft tissue lesions. Chest MRI is useful if there is a high suspicion for necrotizing fasciitis and for surgical planning prior to debridement.⁴

Costochondritis/Other Musculoskeletal Chest Wall Syndrome (CH-4.2)

CH.CP.0004.2.C

v1.0.2026

- Initial evaluation should include a chest x-ray
- CT chest (CPT® 71250 or CPT® 71260) is medically necessary for inconclusive or nondiagnostic findings on chest x-ray AND one of the following:
 - concern for infectious or neoplastic processes
 - persistent symptoms >3 weeks (despite treatment)
- For MRI requests, see the applicable section:
 - **Infection (MS-9.0)**
 - **Muscle and Tendon Injuries (MS-11)**
 - **Joint Instability and Dysfunction (MS-30)**
 - **Chest Wall Mass (CH-22.1)**
- For slipping rib syndrome, dynamic chest ultrasound (CPT® 76604) is medically necessary.
 - CT chest (CPT® 71250 or CPT® 71260) is medically necessary for pre-surgical planning
- For other conditions not mentioned, see **Non-Cardiac Chest Pain - Imaging (CH-4.1)**

Evidence Discussion

Costochondritis is a common cause of chest wall pain in adults presenting to the emergency department and physician's office.^{3,16} It is defined as inflammation of costochondral junctions of ribs or costosternal joints, usually at multiple levels and without any swelling or induration.³ It is a self-limited condition. The diagnosis is largely based on history and physical examination, which reproduces pain on palpation of the chest wall. Upper body movement, deep breathing, and exertional activities often exacerbate the pain.^{3,16} Tietze syndrome presents similarly to costochondritis but includes visible edema at the involved joint(s), typically is unilateral involving the second rib, and is often incited by infection or trauma.¹⁶

There are no laboratory tests or imaging tests findings specifically for the diagnosis of costochondritis.²² If an individual relates a history of dyspnea or chest wall trauma, a chest radiograph or rib series is medically necessary.^{4,16} Chest radiographs can help identify potential sources of previously undifferentiated chest pain such as pneumothorax, pneumomediastinum, fractured ribs, acute and chronic infections, pneumonia, lung mass, and malignancies.¹ A large observational study found that 91%

of individuals with new-onset costochondritis had resolution of pain after three weeks of treatment with rest and nonsteroidal anti-inflammatory drugs.¹⁸ Thus, chest CT should be reserved for individuals who have persistent symptoms greater than 3-4 weeks, or where there is high suspicion for infection and neoplastic processes.³ Scintigraphy has been studied to determine its usefulness to diagnose costochondritis, but it is not specific for the diagnosis.³

Most treatment recommendations are conservative in nature and have been traditionally accepted, perhaps because of the self-limited nature of the condition.^{3,16}

Recalcitrant cases may respond to corticosteroid injections.¹⁶

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.
- Chest CT, chest MRI, and bone scans are not helpful for the diagnosis of slipping rib syndrome. However, they may be helpful in delineating rib anatomy, which would aid in surgical planning.
- Dynamic chest ultrasound accurately diagnoses slipping rib syndrome in 89% of cases and has a 100% negative predictive value.
- Intercostal nerve blocks could be used for diagnostic and therapeutic purposes.

References (CH-4)

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1. Expert Panel on Cardiac Imaging, Beache GM, Mohammed TH, et al. ACR Appropriateness Criteria® Acute Nonspecific Chest Pain-Low Probability of Coronary Artery Disease. *J Am Coll Radiol*. 2020;17(11S):S346-S354. doi:10.1016/j.jacr.2020.09.006.
2. Expert Panel on Cardiac Imaging: Shah AB, Kirsch J, et al. ACR Appropriateness Criteria® Chronic Chest Pain-Noncardiac Etiology Unlikely-Low to Intermediate Probability of Coronary Artery Disease. *J Am Coll Radiol*. 2018;15(11S):S283-S290. doi:10.1016/j.jacr.2018.09.021.
3. Proulx A, Zryd TW. Costochondritis: diagnosis and treatment. *Am Fam Physician*. 2009;80(6):617-620.
4. Expert Panel on Thoracic Imaging, Stowell JT, Walker CM, et al. ACR Appropriateness Criteria® Nontraumatic Chest Wall Pain. *J Am Coll Radiol*. 2021;18(11S):S394-S405. doi:10.1016/j.jacr.2021.08.004.
5. Edmondstone WM. Chest pain and non-respiratory symptoms in acute asthma. *Postgrad Med J*. 2000;76(897):413-414. doi:10.1136/pmj.76.897.413.
6. McConaghy JR, Sharma M, Patel H. Acute chest pain in adults: Outpatient Evaluation. *Am Fam Physician*. 2020;102(12):721-727.
7. Haasenritter J, Biroga T, Keunecke C, et al. Causes of chest pain in primary care--a systematic review and meta-analysis. *Croat Med J*. 2015;56(5):422-430. doi:10.3325/cmj.2015.56.422.
8. Burris AC 2nd, Boura JA, Raff GL, Chinnaiyan KM. Triple Rule Out Versus Coronary CT Angiography in Patients With Acute Chest Pain: Results From the ACIC Consortium. *JACC Cardiovasc Imaging*. 2015;8(7):817-825. doi:10.1016/j.jcmg.2015.02.023.
9. Hollander JE, Chang AM. Triple Rule Out CTA Scans or the Right Test for the Right Patient. *JACC Cardiovasc Imaging*. 2015;8(7):826-827. doi:10.1016/j.jcmg.2015.02.022.
10. Expert Panel on Cardiac Imaging, Kirsch J, Wu CC, et al. ACR Appropriateness Criteria® Suspected Pulmonary Embolism: 2022 Update. *J Am Coll Radiol*. 2022;19(11S):S488-S501. doi:10.1016/j.jacr.2022.09.014.
11. Gulati M, Levy PD, Mukherjee D, et al. 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines [published correction appears in *Circulation*. 2021 Nov 30;144(22):e455. doi: 10.1161/CIR.0000000000001047] [published correction appears in *Circulation*. 2023 Dec 12;148(24):e281. doi: 10.1161/CIR.0000000000001198]. *Circulation*. 2021;144(22):e368-e454. doi:10.1161/CIR.0000000000001029.
12. Lee AL, Harrison SL, Goldstein RS, Brooks D. Pain and its clinical associations in individuals with COPD: a systematic review. *Chest*. 2015;147(5):1246-1258. doi:10.1378/chest.14-2690.
13. Frieling T. Non-Cardiac Chest Pain. *Visc Med*. 2018;34(2):92-96. doi:10.1159/000486440.
14. Yamasaki T, Fass R. Noncardiac chest pain: diagnosis and management. *Curr Opin Gastroenterol*. 2017;33(4):293-300. doi:10.1097/MOG.0000000000000374.
15. Jain S, Bakshi N, Krishnamurti L. Acute Chest Syndrome in Children with Sickle Cell Disease. *Pediatr Allergy Immunol Pulmonol*. 2017;30(4):191-201. doi:10.1089/ped.2017.0814.
16. Mott T, Jones G, Roman K. Costochondritis: Rapid Evidence Review. *Am Fam Physician*. 2021;104(1):73-78.
17. Bader AS, Rubinowitz AN, Gange CP Jr, Bader EM, Cortopassi IO. Imaging in the Evaluation of Chest Pain in the Primary Care Setting, Part 2: Sources of Noncardiac Chest Pain. *Am J Med*. 2020;133(10):1135-1142. doi:10.1016/j.amjmed.2020.04.013
18. Boran M, Boran E. Tietze syndrome and idiopathic costochondritis—treatment modalities, recurrence rates, seasonality. *World J Pharm Res*. 2017;6(8):76-85.
19. Foley Davelaar CM. A Clinical Review of Slipping Rib Syndrome. *Curr Sports Med Rep*. 2021;20(3):164-168. doi:10.1249/JSR.0000000000000821
20. Gress K, Charipova K, Kassem H, et al. A Comprehensive Review of Slipping Rib Syndrome: Treatment and Management. *Psychopharmacol Bull*. 2020;50(4 Suppl 1):189-196.
21. Madeka I, Alaparthi S, Moreta M, et al. A Review of Slipping Rib Syndrome: Diagnostic and Treatment Updates to a Rare and Challenging Problem. *J Clin Med*. 2023;12(24):7671. Published 2023 Dec 14. doi:10.3390/jcm12247671

22. Bolandrini A, Totti V, Segat M, et al. Costochondritis syndrome and thoracic-chest related pain: A scoping review. *medRxiv* 2024. doi: 10.1101/2024.02.11.24302642

Dyspnea/Shortness of Breath (CH-5)

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Dyspnea/Shortness of Breath (CH-5.1)

CH.SB.0005.1.A

v1.0.2026

- Initial evaluation should include a chest x-ray since onset or change in symptoms.
 - CT Chest without contrast (CPT® 71250) OR CT Chest with contrast (CPT® 71260) if x-ray is abnormal.
 - CT Chest without contrast (CPT® 71250, including HRCT), or CT Chest with contrast (CPT® 71260) if the initial chest x-ray is indeterminate and the following evaluations have been conducted, since onset or change in symptoms, and are indeterminate:
 - ECG, echocardiogram or stress testing, and
 - Pulse oximetry and pulmonary function studies (PFT's)
- If pulmonary embolus (PE) is suspected, See **Pulmonary Embolism (PE) (CH-25)**.
- For persistent dyspnea post-COVID-19 infection, see **Coronavirus Disease 2019 (COVID-19) (CH-13.2)**.

Evidence Discussion

There is no standard approach for the evaluation of chronic dyspnea, and data that test diagnostic algorithms against standard clinical care are limited; however, clinical practice algorithms have been proposed and found to be effective.¹³⁻¹⁶ If the diagnosis is not evident after a history and physical exam, initial diagnostic testing with pulse oximetry, spirometry, chest radiography (CR), ECG, and labs is recommended.^{14,15,17} While the individual utility of these tests varies for a specific diagnosis, they are commonly available and easy to perform.¹⁷

Spirometry can identify obstructive lung disease or suggest restrictive lung disease. The flow-volume loop may suggest intra- or extra-thoracic airway obstruction. Some authors recommend full pulmonary function tests as part of the initial investigation, while others consider spirometry an appropriate initial test.^{13,15} Diagnostic accuracy is improved when spirometry is done in addition to a clinical assessment.¹⁷

ECG has a high negative predictive value for cardiac disease but low specificity. Thus, further testing such as echo is often necessary.¹⁷ The recommended timing of echocardiography differs between algorithms but echo is an important test for cardiac causes of dyspnea.^{14,17} The American College of Radiology (ACR) states that for dyspnea of suspected cardiac origin, the initial diagnostic imaging should usually be CR followed by transthoracic echo.²

CR remains a valuable first line investigation of dyspnea.¹⁴ The ACR states that CR should generally be the first imaging study.¹ It may reveal abnormalities or guide further imaging decisions. Data on the diagnostic utility of chest CT for chronic dyspnea

are limited. It is often used following an abnormal CR or if other initial testing is negative. The ACR states that CT may be useful when CR abnormalities require further characterization or clinical findings necessitate additional imaging despite a normal CR.¹ CT without intravenous contrast is usually sufficient unless there is a suspicion for vascular abnormalities. The disadvantage is exposure to ionizing radiation; therefore, CT "requires careful patient selection with consideration given to patient age, risk of diagnostic radiation exposure and estimated diagnostic yield."¹⁷

Background and Supporting Information

- Dyspnea is the subjective experience of breathing discomfort.

Dyspnea/Shortness of Breath Health Equity Considerations

- Dyspnea disproportionately affects individuals with a low socioeconomic status.

Pre-Operative Assessment (CH-5.2)

CH.SB.0005.2.A

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- For pre-operative assessment prior to a planned segmental, lobar, or lung removal, as well as for pre-interventional assessment prior to a planned endobronchial valve (e.g., Zephyr valve) placement, the following are medically necessary:
 - “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) or SPECT/CT (CPT® 78830)
- AND/OR
- CT Chest (CPT® 71250, CPT® 71260 or CPT® 71270) for pre-interventional procedure assessment prior to a planned endobronchial valve (e.g., Zephyr Valve) placement.
 - For robotic assisted lung resection, CT chest (CPT® 71250 OR CPT® 71260) is medically necessary if:
 - Previous diagnostic scan was ≥ 6 weeks ago
 - CPT® 76497 (Unlisted CT procedure) if a CT Chest has been performed < 6 weeks ago

Post Endobronchial Valve (EBV) Placement (CH-5.3)

CH.SB.0005.3.A

v1.0.2026

- Suspected Post EBV Complication:
 - Initial evaluation should include a chest x-ray
 - CT Chest without contrast (CPT[®] 71250) or CT Chest with contrast (CPT[®] 71260) is medically necessary for:
 - acute loss of benefit, lack of initial benefit, increased dyspnea, sudden chest pain, increased cough, suspected valve malposition/migration, or to evaluate target lobe volume reduction

Evidence Discussion

The most common acute complications following EBV placement are pneumothorax, pneumonia, COPD exacerbation and valve migration.¹⁰ Pneumothorax occurs in 20-30% of individuals, the majority within the first 48 hours after the procedure. Individuals who have an acute increase in dyspnea, cough or chest pain, or an acute perceived loss of benefit, should have a chest X-ray (CR) to rule out pneumothorax. If the CR is non-diagnostic, a CT chest should be done to evaluate the valve position, the target lobe and volume reduction more precisely.⁹

Following EBV placement, it may take several days to one month for significant volume reduction and atelectasis of the target lobe to occur. If no significant lung volume reduction is seen on CR at one month, a CT should be done to evaluate valve position.¹⁰ A CT chest is performed routinely at some centers 6-8 weeks after EBV placement.⁹ If there has been no clinical benefit and no lobar atelectasis is evident on CT at 6 weeks, a revision bronchoscopy may be necessary.¹¹ The two most common causes of lack of benefit are the presence of interlobar collateral ventilation or valve misplacement/migration.

References (CH-5)

v1.0.2026

1. Expert Panel on Thoracic Imaging; Christensen JD, Harowicz M, et al. ACR Appropriateness Criteria® Chronic Dyspnea-Noncardiovascular Origin. 2024.
2. Expert Panel on Cardiac Imaging; Bolen MA, Bin Saeedan MN, et al. ACR Appropriateness Criteria® Dyspnea-Suspected Cardiac Origin (Ischemia Already Excluded): 2021 Update. *J Am Coll Radiol*. 2022;19(5S):S37-S52.
3. Morton K. Chapter 4. In: Morton K, eds. *Diagnostic Imaging: Nuclear Medicine*. Amirsys;2007:2-15.
4. Thrall JH, Ziessman HA. *Nuclear Medicine: The Requisites*. 2nd ed. Mosby; 2001:145-165.
5. Sciruba FC, Ernst A, Herth FJ, et al. A randomized study of endobronchial valves for advanced emphysema. *N Engl J Med*. 2010;363(13):1233-1244. doi:10.1056/NEJMoa0900928.
6. Davey C, Zoumot Z, Jordan S, et al. Bronchoscopic lung volume reduction with endobronchial valves for patients with heterogeneous emphysema and intact interlobar fissures (the BeLieVeR-HiFi study): a randomised controlled trial. *Lancet*. 2015;386(9998):1066-1073. doi:10.1016/S0140-6736(15)60001-0.
7. Klooster K, ten Hacken NH, Hartman JE, Kerstjens HA, van Rikxoort EM, Slebos DJ. Endobronchial Valves for Emphysema without Interlobar Collateral Ventilation. *N Engl J Med*. 2015;373(24):2325-2335. doi:10.1056/NEJMoa1507807.
8. Kristiansen JF, Perch M, Iversen M, Krakauer M, Mortensen J. Lobar Quantification by Ventilation/Perfusion SPECT/CT in Patients with Severe Emphysema Undergoing Lung Volume Reduction with Endobronchial Valves. *Respiration*. 2019;98(3):230-238. doi:10.1159/000500407.
9. Koster TD, Klooster K, Ten Hacken NHT, van Dijk M, Slebos DJ. Endobronchial valve therapy for severe emphysema: an overview of valve-related complications and its management. *Expert Rev Respir Med*. 2020;14(12):1235-1247. doi:10.1080/17476348.2020.1813571.
10. Slebos DJ, Shah PL, Herth FJ, Valipour A. Endobronchial Valves for Endoscopic Lung Volume Reduction: Best Practice Recommendations from Expert Panel on Endoscopic Lung Volume Reduction. *Respiration*. 2017;93(2):138-150. doi:10.1159/000453588.
11. Klooster K, Slebos DJ. Endobronchial Valves for the Treatment of Advanced Emphysema. *Chest*. 2021;159(5):1833-1842. doi:10.1016/j.chest.2020.12.007.
12. Parshall MB, Schwartzstein RM, Adams L, et al. An official American Thoracic Society statement: update on the mechanisms, assessment, and management of dyspnea. *Am J Respir Crit Care Med*. 2012;185(4):435-452. doi:10.1164/rccm.201111-2042ST.
13. Hudler A, Holguin F, Althoff M, Fuhlbrigge A, Sharma S. Pathophysiology and clinical evaluation of the patient with unexplained persistent dyspnea. *Expert Rev Respir Med*. 2022;16(5):511-518. doi:10.1080/17476348.2022.2030222.
14. Budhwar N, Syed Z. Chronic Dyspnea: Diagnosis and Evaluation. *Am Fam Physician*. 2020;101(9):542-548.
15. Sunjaya AP, Homaira N, Corcoran K, Martin A, Berend N, Jenkins C. Assessment and diagnosis of chronic dyspnoea: a literature review. *NPJ Prim Care Respir Med*. 2022;32(1):10. Published 2022 Mar 8. doi:10.1038/s41533-022-00271-1.
16. Oelsner EC, Lima JA, Kawut SM, et al. Noninvasive tests for the diagnostic evaluation of dyspnea among outpatients: the Multi-Ethnic Study of Atherosclerosis lung study. *Am J Med*. 2015;128(2):171-180.e5. doi:10.1016/j.amjmed.2014.09.023.
17. Ferry OR, Huang YC, Masel PJ, Hamilton M, Fong KM, Bowman RV, McKenzie SC, Yang IA. Diagnostic approach to chronic dyspnoea in adults. *J Thorac Dis*. 2019 Oct;11(Suppl 17):S2117-S2128. doi: 10.21037/jtd.2019.10.53. PMID: 31737340; PMCID: PMC6831921.
18. Milos RI, Bartha C, Röhrich S, et al. Imaging in patients with acute dyspnea when cardiac or pulmonary origin is suspected. *BJR Open*. 2023;5(1):20220026. Published 2023 Feb 2. doi:10.1259/bjro.20220026
19. Zhou J, Nehme E, Dawson L, et al. Impact of socioeconomic status on presentation, care quality and outcomes of patients attended by emergency medical services for dyspnoea: a population-based cohort study. *J Epidemiol Community Health*. 2024;78(4):255-262. Published 2024 Mar 8. doi:10.1136/jech-2023-220737
20. Gupta YS, Simpson S, Graham R, et al. Imaging of Bronchoscopic Lung Volume Reduction Using Endobronchial Valves. *Radiographics*. 2025;45(3):e240156. doi:10.1148/rg.240156

21. Dass C, Goldbach A, Dako F, Kumaran M, Steiner R, Criner GJ. Role of Imaging in Bronchoscopic Lung Volume Reduction Using Endobronchial Valve: State of the Art Review. *J Thorac Imaging*. 2021;36(3):131-141. doi:10.1097/RTI.0000000000000549

Hemoptysis (CH-6)

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Hemoptysis (CH-6.1)

CH.HS.0006.1.A

v1.0.2026

- Following a chest x-ray performed after hemoptysis started or worsened the following is medically necessary:
 - CT Chest with contrast (CPT[®] 71260) or CTA Chest (CPT[®] 71275)
- For recurrent hemoptysis (hemoptysis occurring after medical therapy or embolization), or related to pre-bronchial artery embolization planning, the following is medically necessary:
 - CTA Chest (CPT[®] 71275) (preferred) or CT chest with contrast (CPT[®] 71260) if requested

NOTE:

- CT Chest without contrast, (CPT[®] 71250), is only warranted in individuals with poor renal function or life-threatening contrast allergy.
- There is no data to support the use of CT Chest without and with contrast, (CPT[®] 71270) in the diagnosis of hemoptysis.

Background and Supporting Information

- The most common causes of hemoptysis are acute respiratory tract infections, respiratory tract neoplasm, bronchiectasis, and tuberculosis. Chest x-ray is the most common initial test because it is easy to obtain, can help lateralize the site of bleeding in 32-80% of cases, and may demonstrate underlying parenchymal abnormalities. If no cause is found on chest x-ray, further evaluation is necessary with CT chest with contrast, CTA chest, and/or bronchoscopy. Angiographic localization of the site of bleeding can be challenging, time-consuming, and requires a significant contrast load; therefore, pre-procedural chest CT and/or bronchoscopy to help localize the bleeding site is valuable. Determination of which arteries to embolize is based on a combination of CT, bronchoscopic localization of bleeding when applicable, and angiographic findings.

Reference (CH-6)

v1.0.2026

1. Expert Panel on Thoracic Imaging; Olsen KM, Manouchehr-Pour S, et al. ACR Appropriateness Criteria® Hemoptysis. *J Am Coll Radiol*. 2020;17(5S):S148-S159. doi:10.1016/j.jacr.2020.01.043
2. O'Gurek D, Choi HYJ. Hemoptysis: Evaluation and Management. *Am Fam Physician*. 2022;105(2):144-151.
3. Charya AV, Holden VK, Pickering EM. Management of life-threatening hemoptysis in the ICU. *J Thorac Dis*. 2021;13(8):5139-5158. doi:10.21037/jtd-19-3991
4. Kathuria H, Hollingsworth HM, Vilvendhan R, Reardon C. Management of life-threatening hemoptysis. *J Intensive Care*. 2020;8:23. Published 2020 Apr 5. doi:10.1186/s40560-020-00441-8

Bronchiectasis (CH-7)

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Bronchiectasis (CH-7.1)

CH.BR.0007.1.A

v1.0.2026

- High resolution CT Chest (HRCT) without contrast (CPT® 71250) for ANY of the following:
 - To confirm suspected diagnosis of bronchiectasis after an initial x-ray.
 - For known bronchiectasis with worsening symptoms or worsening PFT's.
 - For hemoptysis with known or suspected bronchiectasis.

Evidence Discussion

The British Thoracic Society (BTS) recommends performing a baseline chest x ray (CR) in people with suspected bronchiectasis followed by a thin section (< or equal to 1 mm slice thickness) CT scan to confirm the diagnosis.⁷ According to the American College of Radiology (ACR), CR is relatively insensitive but is medically necessary and often performed as initial imaging for evaluation of associated conditions and exclusion of diseases that cause similar symptoms.⁹ High resolution CT chest (HRCT) is considered the most accurate imaging modality for the diagnosis of bronchiectasis.⁸ The ACR states that CT chest without contrast is medically necessary for suspected bronchiectasis to identify and characterize the severity and distribution of bronchiectasis and to evaluate any associated parenchymal lung diseases.⁹ CT chest can help identify an etiology, such as allergic bronchopulmonary aspergillosis, Primary Ciliary Dyskinesia, tracheobronchomegaly, or a foreign body.^{7,8}

MRI chest for suspected bronchiectasis is not medically necessary because it is inferior to CT for evaluating lung parenchyma, and its use is mainly limited to research settings.⁹

CR is often the initial chest imaging exam to evaluate acute conditions in people with bronchiectasis, such as pneumonia or hemoptysis. CT chest without contrast is medically necessary for the evaluation of complications and assessing changes in clinical status.⁹ CT chest with contrast is medically necessary in the setting of a suspected acute infection and associated complication, such as abscess.⁹ The BTS recommends a CT chest for people with a deteriorating clinical status, such as worsening symptoms, increased frequency or severity of acute exacerbations, or decreasing lung function.⁷ They recommend a CT chest with contrast if PE is suspected. CTA chest with contrast is medically necessary in the setting of hemoptysis to identify dilated bronchial arteries or systemic collateral vessels and for pre-procedure planning.^{8,9}

High quality evidence in favor of repeated imaging is lacking.⁸ CR may not show structural changes. Repeat HRCT carries the risk of increased radiation. Individuals with diseases associated with bronchiectasis may be evaluated with CT to help guide

therapy and provide prognostic information.⁹ The current indication for repeat HRCT is clinical deterioration.⁷)

Bronchiectasis Health Equity Considerations

- Bronchiectasis is more prevalent among females. The most aggressive disease occurs among post-menopausal females.

Adult Cystic Fibrosis (CH-7.2)

CH.BR.0007.2.A

v1.0.2026

- CT Chest without contrast (CPT® 71250) or with contrast (CPT® 71260) is medically necessary for the following (without initial chest x-ray):
 - Suspected or initial diagnosis of Cystic Fibrosis
 - Biennially, (every 2 years), for routine surveillance
 - Persistent respiratory symptoms with reduced lung function despite therapy
 - Exacerbations when chest x-ray is indeterminate
 - Hemoptysis
 - Suspected fungal pneumonia
 - Pre and post-lung transplant evaluation
- See **Bronchiectasis (CH-7.1)**

Evidence Discussion

Imaging is an important method of evaluating the lungs in people with cystic fibrosis (CF). It has a stronger correlation with disease severity than pulmonary function tests and facilitates prompt therapy which may help limit irreversible lung damage.¹⁰ Chest x-ray (CR) is less sensitive than CT chest at detecting early structural changes and disease progression.⁴ However, CR is still most commonly used as the first line imaging examination for the assessment of acute complications due to its low cost, availability, low radiation and speed of acquisition.¹¹ CT is increasingly being used to monitor disease progression and make treatment decisions, but the routine use of CT for short term follow up during pulmonary exacerbations is not recommended due to the risk of a high cumulative radiation dose. Low dose chest CT (LDCT) is useful in individuals with persistent respiratory symptoms and decreased lung function despite appropriate therapy.⁴ There is little evidence regarding the optimal timing of CT monitoring. The current best clinical practice in several European CF centers is a CT every two years with a radiation dose as low as reasonably achievable (ALARA). Follow up imaging is determined by individual-dependent clinical factors.⁴ The CF Foundation guidelines for adult CF clinical care recommend CR every 2-4 years in those with a stable clinical status and state that imaging should be considered if there are symptoms or signs of an acute pulmonary exacerbation, pneumothorax, lobar atelectasis or hemoptysis.^{12,13}

Several emerging techniques offer promising means of pulmonary imaging using less ionizing radiation, including ultra-low dose CT (ULDCT) and MRI.^{10,14,18,20} The radiation dose with CR is 0.02mSv, 5.4 mSv for standard dose CT, 1 to 2 mSv for LDCT, and 0.05-0.08mSv for ULDCT. While pulmonary MRI has promise as a means of routinely monitoring CF lung disease, it is currently limited by a lack of availability, high cost, lack

of validation and standardized protocols, and the need for sedation or anesthesia in some individuals.^{4,10}

Adult Cystic Fibrosis Health Equity Considerations

- There are disparities in cystic fibrosis outcomes related to race, ethnicity, socioeconomic status, geographic location, sexuality, and gender identity.
 - People with disadvantaged backgrounds have worse cystic fibrosis health outcomes and tend to die younger than those without.
 - Women tend to have worse cystic fibrosis outcomes than men.

References (CH-7)

v1.0.2026

1. Rosen MJ. Chronic cough due to bronchiectasis: ACCP evidence-based clinical practice guidelines. *Chest*. 2006;129(1 Suppl):122S-131S. doi:10.1378/chest.129.1_suppl.122s.
2. Pasteur MC, Bilton D, Hill AT; British Thoracic Society Bronchiectasis non-CF Guideline Group. British Thoracic Society guideline for non-CF bronchiectasis. *Thorax*. 2010;65 Suppl 1:i1-i58. doi:10.1136/thx.2010.136119.
3. Expert Panel on Thoracic Imaging; Olsen KM, Manouchehr-Pour S, et al. ACR Appropriateness Criteria® Hemoptysis. *J Am Coll Radiol*. 2020;17(5S):S148-S159. doi:10.1016/j.jacr.2020.01.043.
4. Ciet P, Bertolo S, Ros M, et al. State-of-the-art review of lung imaging in cystic fibrosis with recommendations for pulmonologists and radiologists from the "iMAging managEment of cySTic fibROsis" (MAESTRO) consortium. *Eur Respir Rev*. 2022;31(163):210173. Published 2022 Mar 23. doi: 10.1183/16000617.0173-2021.
5. Averill S, Lubner MG, Menias CO, et al. Multisystem Imaging Findings of Cystic Fibrosis in Adults: Recognizing Typical and Atypical Patterns of Disease. *AJR Am J Roentgenol*. 2017;209(1):3-18. doi:10.2214/AJR.16.17462.
6. Flume PA, Basavaraj A, Garcia B, et al. Towards development of evidence to inform recommendations for the evaluation and management of bronchiectasis. *Respir Med*. 2023;211:107217. doi:10.1016/j.rmed.2023.107217.
7. Hill AT, Sullivan AL, Chalmers JD, et al. British Thoracic Society Guideline for bronchiectasis in adults. *Thorax*. 2019;74(Suppl 1):1-69. doi:10.1136/thoraxjnl-2018-212463.
8. Ledda RE, Balbi M, Milone F, et al. Imaging in non-cystic fibrosis bronchiectasis and current limitations. *BJR Open*. 2021;3(1):20210026. Published 2021 Jul 29. doi:10.1259/bjro.20210026.
9. Little BP, Walker CM, Bang TJ, et al. ACR appropriateness criteria: tracheobronchial disease. 2024.
10. Crowley C, Connor OJO, Ciet P, Tiddens HAWM, Maher MM. The evolving role of radiological imaging in cystic fibrosis. *Curr Opin Pulm Med*. 2021;27(6):575-585. doi:10.1097/MCP.0000000000000828.
11. Murphy KP, Maher MM, O'Connor OJ. Imaging of Cystic Fibrosis and Pediatric Bronchiectasis. *AJR Am J Roentgenol*. 2016;206(3):448-454. doi:10.2214/AJR.15.14437.
12. Yankaskas J, Marshall B, Sufian B, et al. Cystic Fibrosis Adult Care: Consensus Conference Report. *Chest* 2004 1; 125 (1Suppl):1S-39S.
13. Flume P, Mogayzel P, Robinson K, et al. Cystic Fibrosis Pulmonary Guidelines; pulmonary complications: hemoptysis and pneumothorax. *Am J Respir Crit Care Med* 2010. Vol 182: 298-306.
14. Goralski JL, Stewart NJ, Woods JC. Novel imaging techniques for cystic fibrosis lung disease. *Pediatr Pulmonol*. 2021;56 Suppl 1(Suppl 1):S40-S54. doi:10.1002/ppul.24931.
15. Tiddens HAWM, Meerburg JJ, van der Eerden MM, Ciet P. The radiological diagnosis of bronchiectasis: what's in a name?. *Eur Respir Rev*. 2020;29(156):190120. Published 2020 Jun 17. doi:10.1183/16000617.0120-2019
16. Meerburg JJ, Veerman GDM, Aliberti S, Tiddens HAWM. Diagnosis and quantification of bronchiectasis using computed tomography or magnetic resonance imaging: A systematic review. *Respir Med*. 2020;170:105954. doi:10.1016/j.rmed.2020.105954
17. Brooke-Hollidge A, Conway J, Lewis A. Gender differences in non-cystic fibrosis bronchiectasis severity and bacterial load: the potential role of hormones. *Ther Adv Respir Dis*. 2021;15:17534666211035311. doi:10.1177/17534666211035311
18. Hallouch O, Marinos J, Thibault F, et al. Cystic fibrosis in the 21st century: what every radiologist should know. *Clin Imaging*. 2022;84:118-129. doi:10.1016/j.clinimag.2022.02.004
19. Bugenhagen SM, Grant JCE, Rosenbluth DB, Bhalla S. Update on the Role of Chest Imaging in Cystic Fibrosis. *Radiographics*. 2024;44(9):e240008. doi:10.1148/rg.240008
20. McBennett K, MacAskill CJ, Keshock E, et al. Magnetic resonance imaging of cystic fibrosis: Multi-organ imaging in the age of CFTR modulator therapies. *J Cyst Fibros*. 2022;21(2):e148-e157. doi:10.1016/j.jcf.2021.11.006
21. Oates GR, Schechter MS. Aiming to Improve Equity in Pulmonary Health: Cystic Fibrosis. *Clin Chest Med*. 2023;44(3):555-573. doi:10.1016/j.ccm.2023.03.011

22. Oates GR, Schechter MS. Socioeconomic determinants of respiratory health in patients with cystic fibrosis: implications for treatment strategies. *Expert Rev Respir Med.* 2022;16(6):637-650. doi:10.1080/17476348.2022.2090928
23. Jain R, Kazmerski TM, Aitken ML, et al. Challenges Faced by Women with Cystic Fibrosis. *Clin Chest Med.* 2021;42(3):517-530. doi:10.1016/j.ccm.2021.04.010

Bronchitis (CH-8)

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Bronchitis (CH-8.1)

CH.BH.0008.1.A

v1.0.2026

- Chest x-ray is medically necessary as initial imaging if symptoms persist or worsen. Advanced imaging is not medically necessary for bronchitis unless directed by condition specific guideline.
 - See the following guidelines for additional information:
 - For Pneumonia, see: Pneumonia (CH-13.1).
 - For Cough, see: Cough (CH-3.1).
 - For Pleural Effusion, see: Pleural Effusion (CH-18.1).
 - For pulmonary mass, see: Pulmonary Nodule (CH-16.1), Pulmonary Nodule (CH-16.1).

Evidence Discussion

Acute bronchitis is a self-limited respiratory infection characterized by cough due to acute inflammation of the trachea and large airways without evidence of pneumonia.^{1, 2} This syndrome should be distinguished from the common cold, an acute exacerbation of chronic bronchitis and acute asthma.¹

Cough associated with acute bronchitis typically lasts about two to three weeks. Other diagnoses must be considered when cough persists for more than three weeks.¹ Acute bronchitis is mainly caused by viruses, and antibiotics are not typically indicated in individuals without chronic lung disease^{1, 2}. Imaging is primarily used to rule out pneumonia. Evidence-based guidelines from the American College of Chest Physicians state that imaging is not needed in individuals with acute bronchitis symptoms who have normal vital signs and normal lung examination findings.²

References (CH-8)

v1.0.2026

1. Braman SS. Chronic cough due to acute bronchitis: ACCP evidence-based clinical practice guidelines. *Chest*. 2006;129(1 Suppl):95S-103S. doi:10.1378/chest.129.1_suppl.95s.
2. Kinkade S, Long NA. Acute bronchitis. *Am Fam Physician*. 2016;94(7):560-565.
3. Smith MP, Lown M, Singh S, et al. Acute Cough Due to Acute Bronchitis in Immunocompetent Adult Outpatients: CHEST Expert Panel Report. *Chest*. 2020;157(5):1256-1265. doi:10.1016/j.chest.2020.01.044

Asbestos Exposure (CH-9)

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Asbestos Exposure (CH-9.1)

CH.AE.0009.1.A

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- Chest x-ray as radiographic screening for asbestos exposure.
 - Stable calcified pleural plaques on chest x-ray do not require advanced imaging of the chest.
- CT Chest is not medically necessary to screen populations at risk for asbestos-related diseases.
- High resolution CT Chest (HRCT) (CPT® 71250) for ANY of the following:
 - Any change seen on chest x-ray
 - Progressive respiratory symptoms that may indicate the development or progression of asbestos related interstitial fibrosis

Evidence Discussion

Several well-conducted epidemiologic studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos mines have demonstrated that exposure to asbestos is associated with an increased incidence of asbestosis, lung cancer, mesothelioma, as well as other neoplasms. Asbestosis is a fibrotic lung disease caused by accumulation of asbestos fibers in the lungs. The diagnosis of asbestosis is most commonly made based on a history of exposure to asbestos, the presence of characteristic radiologic abnormalities, end-inspiratory rales, and other clinical features.¹⁻³

A chest x-ray of an individual exposed to asbestos may show pleural plaques, pleural calcifications, pleural fibrosis, or small irregular parenchymal opacities. Lung cancer risk is not elevated among individuals with asbestos-related pleural plaques in the absence of asbestosis.¹⁻³

Chest x-ray is currently medically necessary to screen for lung changes resulting from asbestos exposure and is recommended for those who have had relatively heavy exposure to asbestos. However, chest x-rays lack specificity. When a chest x-ray abnormality is indeterminate, High Resolution CT Chest (HRCT) is useful in revealing characteristic parenchymal abnormalities. There is a lack of consensus among experts regarding the value of HRCT for screening of asbestos-related pulmonary disease.¹⁻³

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-9)

v1.0.2026

1. OSHA, Occupational Safety and Health Standards, Medical surveillance guidelines for asbestos, 1910.1001 App H. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9995.
2. Banks DE, Shi R, McLarty J, 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
3. Agency for Toxic Substances and Disease Registry. Asbestos. Updated 2011. <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=4>.
4. Bellis D, Croce A, Glorioso A, Bertolotti M, Maconi A. Asbestos exposure diagnosis in pulmonary tissues. *Pathologica*. 2024;116(4):207-215. doi:10.32074/1591-951X-930

Chronic Obstructive Pulmonary Disease (COPD) (CH-10)

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COPD (CH-10.1)

CH.PD.0010.1.A

v1.0.2026

- Chest x-ray should be performed initially.
 - CT Chest without contrast (CPT[®] 71250) or CT Chest with contrast (CPT[®] 71260) can be performed if:
 - Emphysema is known or suspected and a pre-operative study for Lung Volume Reduction Surgery (LVRS) is being requested. OR
 - For known COPD:
 - individuals with persistent exacerbation OR
 - symptoms out of proportion to disease severity OR
 - FEV1 <45% of predicted
 - PFT's, appropriate laboratory studies, and chest x-ray do not reveal a definitive diagnosis and there is suspicion of an additional diagnosis including, but not limited to:
 - Bronchiectasis
 - Sarcoidosis
 - Emphysema
 - Pneumoconiosis
 - Idiopathic pulmonary fibrosis
 - Langerhans cell histiocytosis
 - Hypersensitivity pneumonitis
 - Bronchiolitis obliterans
 - Lipoid pneumonia
 - Drug toxicity
 - Lymphangitic cancer
 - Alpha-1-Antitrypsin Deficiency
- Lung cancer screening is discussed in the following guideline:
 - See "Screening Indications" in **Lung Cancer Screening (CH-33)**
- Pre-interventional lung procedure assessment prior to a planned endobronchial valve (e.g., Zephyr valve) placement
 - See **Pre-Operative Assessment (CH-5.2)**

Evidence Discussion

Chest x-ray (CR) is usually the appropriate initial imaging study for suspected COPD to exclude alternative diagnoses and evaluate for comorbidities and complications.¹⁻³ CR, pulmonary function tests (PFT's) and selected blood tests lead to a specific diagnosis

in a significant proportion of people with chronic dyspnea.³ CT has increased sensitivity and specificity for determining the type, severity, and distribution of emphysema and bronchial abnormalities.^{1,3} It is an important part of the pre-procedure evaluation process for lung volume reduction surgery, endobronchial valve placement, and lung transplantation.³ The GOLD 2023 report recommends that CT be considered for individuals with COPD with persistent exacerbations and concern for another diagnosis, such as bronchiectasis or an atypical infection, or symptoms out of proportion to the disease severity suggested by PFT's.² Some authors have proposed broadening the definition of COPD to include CT-detected emphysema, air trapping or airway wall thickening, even in the absence of airflow obstruction on spirometry.^{5,6}

CT is helpful if a smoking-related interstitial lung disease, such as pulmonary Langerhans cell histiocytosis or Combined Pulmonary Fibrosis and Emphysema, is suspected.^{7,8} It is recommended following a diagnosis of alpha-1 antitrypsin deficiency.⁹ CT is also used in the evaluation of central airway abnormalities associated with COPD, such as tracheobronchomalacia and excessive dynamic airways collapse.³ Annual lung cancer screening CT's should be performed in current or former smokers who meet the USPSTF criteria, but screening CT's are not recommended for those with COPD not due to smoking because there is insufficient evidence to establish benefit over harm.³

COPD exacerbations are characterized by dyspnea, cough and/or sputum which worsen over a period of less than two weeks.³ They are mainly caused by respiratory viral infections. CR is often performed to rule out alternative diagnoses, such as pneumonia, pneumothorax or pulmonary edema.

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.

References (CH-10)

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1. Expert Panel on Thoracic Imaging: Christensen JD, Harowicz M, et al. ACR Appropriateness Criteria® Chronic Dyspnea-Noncardiovascular Origin. 2024.
2. 2023 GOLD Report - Global Initiative for Chronic Obstructive Lung Disease - GOLD. Global Initiative for Chronic Obstructive Lung Disease - GOLD. Published November 12, 2023. <https://goldcopd.org/2023-gold-report-2/>.
3. Raoof S, Shah M, Braman S, et al. Lung Imaging in COPD Part 2: Emerging Concepts. *Chest*. 2023;164(2):339-354. doi:10.1016/j.chest.2023.02.049.
4. Raoof S, Shah M, Make B, et al. Lung Imaging in COPD Part 1: Clinical Usefulness. *Chest*. 2023;164(1):69-84. doi:10.1016/j.chest.2023.03.007.
5. Lowe KE, Regan EA, Anzueto A, et al. COPDGene® 2019: Redefining the Diagnosis of Chronic Obstructive Pulmonary Disease. *Chronic Obstr Pulm Dis*. 2019;6(5):384-399. doi:10.15326/jcopdf.6.5.2019.0149.
6. Ferrera MC, Labaki WW, Han MK. Advances in Chronic Obstructive Pulmonary Disease. *Annu Rev Med*. 2021;72:119-134. doi:10.1146/annurev-med-080919-112707.
7. Cottin V, Selman M, Inoue Y, et al. Syndrome of Combined Pulmonary Fibrosis and Emphysema: An Official ATS/ERS/JRS/ALAT Research Statement. *Am J Respir Crit Care Med*. 2022;206(4):e7-e41. doi:10.1164/rccm.202206-1041ST.
8. Guiot J, Henket M, Frix AN, et al. Combined obstructive airflow limitation associated with interstitial lung diseases (O-ILD): the bad phenotype ?. *Respir Res*. 2022;23(1):89. Published 2022 Apr 11. doi:10.1186/s12931-022-02006-9.
9. Stoller JK, Hupertz V, Aboussouan LS. Alpha-1 Antitrypsin Deficiency. In: Adam MP, Feldman J, Mirzaa GM, et al., eds. GeneReviews®. Seattle (WA): University of Washington, Seattle; October 27, 2006.
10. Tanabe N, Nakagawa H, Sakao S, et al. Lung imaging in COPD and asthma. *Respir Investig*. 2024;62(6):995-1005. doi:10.1016/j.resinv.2024.08.014
11. Johnson EM, Little BP, Sonavane SK, & Stowell JT. Imaging of Chronic Obstructive Pulmonary Disease. *Advances in Clinical Radiology*. 2023;5:183–195. doi:10.1016/j.yacr.2023.04.004
12. Labaki WW, Agusti A, Bhatt SP, et al. Leveraging Computed Tomography Imaging to Detect Chronic Obstructive Pulmonary Disease and Concomitant Chronic Diseases. *Am J Respir Crit Care Med*. 2024;210(3):281-287. doi:10.1164/rccm.202402-0407PP
13. Elbehairy AF, Marshall H, Naish JH, et al. Advances in COPD imaging using CT and MRI: linkage with lung physiology and clinical outcomes. *Eur Respir J*. 2024;63(5):2301010. Published 2024 May 2. doi:10.1183/13993003.01010-2023

Interstitial Disease (CH-11)

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Interstitial Lung Disease (ILD)/Diffuse Lung Disease (DLD) (CH-11.1)

CH.ID.0011.1.A

v1.0.2026

- EITHER high resolution CT Chest (HRCT) without contrast (CPT® 71250) (the diagnostic modality of choice) OR CT Chest with contrast (CPT® 71260) to evaluate for the following:
 - Interstitial changes or diffuse parenchymal changes identified on other imaging (including chest x-ray) (See **Dyspnea/Shortness of Breath (CH-5.1)**)
 - In individuals that have pulmonary symptoms with abnormal pulmonary function studies (PFT's) and a normal chest x-ray and there is high clinical suspicion for ILD or DLD, including but not limited to, the following entities: Hypersensitivity Pneumonitis, Cryptogenic Organizing Pneumonia (COP, formally known as BOOP), and Eosinophilic Pneumonia.
 - Initial imaging to identify ILD/DLD in individuals with a high suspicion for connective tissue disease or diagnosis of connective tissue disease (based upon autoantibody testing, serology, etc.), including, but not limited to:
 - rheumatoid arthritis
 - scleroderma
 - idiopathic inflammatory myopathies (polymyositis, dermatomyositis, inclusion body myositis)
 - systemic lupus erythematosus
 - Sjögren's syndrome
 - mixed connective tissue disease
 - Significant exposure to a substance or medication (linked to ILD/DLD) and concern for:
 - Absterosis
 - Silicosis
 - Coal miner's lung disease
 - Drug induced pulmonary toxicity
 - Follow-up CT chest (CPT® 71250 or CPT® 71260) for worsening symptoms or PFT's, guide for steroid taper, or baseline prior to re-exposure to offending agent
 - Timing at the discretion of the treating provider
 - At any time for detection of Progressive Pulmonary Fibrosis (PPF), in individuals with ILD of known or unknown etiology, defined by at least one of the following:
 - New or worsening respiratory symptoms

- Worsening PFT's, defined as decline of either:
 - FVC of 5% or greater within the past year
 - DLCO of 10% or greater within the past year
- Annually in individuals with known pulmonary fibrosis if needed for:
 - serial examination for improvements in diagnostic accuracy, or
 - evaluation of disease reversibility, stability, or progression.
- Concern for interstitial lung disease post-COVID, See **Coronavirus Disease 2019 (COVID-19) (CH-13.2)**
- HRCT can be done even if a regular CT Chest has been done previously. HRCT is done with a thinner-slice protocol that can provide additional details to help determine ILD subtype.
- HRCT can also be done with inspiratory/expiratory and supine/prone views.

Evidence Discussion

ILD is often suspected in those with chronic dyspnea or non-productive cough, especially in the setting of an inhalational exposure or systemic disease known to be associated with lung involvement.^{1,7,11} Chest x-ray (CR) and CT chest without contrast are medically necessary for suspected ILD and provide complementary information.^{1,7} A normal CR does not rule out ILD, as CR can be normal in up to 10% of individuals with ILD. Its primary function is to evaluate for an alternative diagnosis. CR remains an important imaging modality to screen for occupational lung disease.¹ High resolution CT (HRCT) has higher sensitivity and specificity for ILD. HRCT may help guide a biopsy site or provide a definitive diagnosis, making a biopsy unnecessary.^{1,7} CT can provide prognostic information: individuals with honeycombing or a usual interstitial pneumonia (UIP) pattern on CT have increased mortality.¹²

CR and CT chest without contrast are medically necessary for evaluation of an acute exacerbation of ILD.⁷ They can help exclude alternative causes for worsening clinical symptoms and confirm abnormalities consistent with progression of ILD. There are no data to support routine surveillance imaging of ILD, but serial CT's can improve diagnostic accuracy and evaluate disease stability, reversibility or progression.⁷ The optimal interval for follow up HRCT to determine disease progression in idiopathic pulmonary fibrosis (IPF) is unknown. Raghu et al recommend consideration of an annual HRCT in people with IPF if there is clinical suspicion of worsening fibrosis or to screen for complications such as lung cancer.⁷ In people with an ILD other than IPF and radiologic evidence of fibrosis, disease progression on HRCT is one of three criteria used to define progressive pulmonary fibrosis.^{7,13}

Interstitial lung abnormalities (ILA) are abnormalities on CT suggestive of ILD in people without a prior clinical diagnosis.^{10,14} They are common incidental findings, especially in older people. ILA are a radiologic observation. Differentiation between ILA and clinical or subclinical ILD must be on the basis of a clinical evaluation. When respiratory

signs/symptoms or functional impairment is present, ILA likely represent mild ILD. The morphology and distribution of ILA are important: subpleural fibrotic ILA are most likely to progress. There is minimal evidence to support a specific management plan for ILA. Hatabu et al recommend that when ILA are detected, a dedicated HRCT chest can help confirm and characterize the abnormalities, especially if the initial scan was incomplete (i.e., a CT abdomen) or not performed with thin sections.¹⁴ Hunninghake et al recommend that a HRCT should be done in those with ILA.¹⁰ If clinically significant ILD is ruled out, Hatabu et al recommend a repeat CT at 12-24 months for those with subpleural fibrotic ILA or other risk factors for progression to ILD.¹⁴ However, participants in a consensus survey disagreed about repeating a HRCT at the follow up evaluation.¹⁰ People with nonfibrotic nonsubpleural ILA and no symptoms or physiologic impairment do not need reimaging.^{14,15}

Background and Supporting Information

- DLD refers to diffuse parenchymal lung diseases or interstitial lung diseases. There are a multitude of pathologies that demonstrate involvement of the alveoli, airways, or both, in addition to the pulmonary interstitium. A single term of ILD would not fully address the entities that are mostly parenchymal in nature, hence the term Diffuse Lung Disease is more technically correct. Both terms are included here for convenience and recognition.
- There is no relevant literature to support the use of CT with IV contrast for initial or follow-up imaging of ILD; however, IV contrast may be of use in evaluation of alternative diagnoses with overlapping clinical features or conditions that also involve the pleura, mediastinum, and pulmonary vessels.
- Progression of fibrosis is typically assessed visually, relying on the percentage of lung volume containing fibrotic features in the upper, mid, and lower lung zones. An increased extent of fibrotic features denotes progression. These may include increased traction bronchiectasis and bronchiolectasis, new ground-glass opacity with traction bronchiectasis, new fine reticulation, increased coarseness of reticular abnormality, new or increased honeycombing, and increased lobar volume loss.

E-cigarette, or Vaping, Product Use– Associated Lung Injury (EVALI) (CH-11.2)

CH.ID.0011.2.A

v1.0.2026

- Chest x-ray is medically necessary as first line imaging for suspected EVALI.
- CT Chest with or without contrast (CPT® 71250 or CPT® 71260) is medically necessary if:
 - Clinical suspicion for EVALI but negative chest x-ray
 - To identify extent of pulmonary involvement identified on chest x-ray
 - Severe (e.g., tachycardia, tachypnea, or hypoxia (O₂ 95% or less)) or worsening disease (does not require a repeat chest x-ray)
 - To rule out other diagnoses (infection, pulmonary edema, etc.)
 - Clinical suspicion of pneumothorax or pneumomediastinum (See **Pneumothorax/Hemothorax (CH-19.1)**)

Evidence Discussion

EVALI is a toxic inhalational acute lung injury with imaging and histopathologic patterns of organizing pneumonia and/or diffuse alveolar damage.^{16,17} Individuals with EVALI mainly present with respiratory symptoms (e.g., shortness of breath, cough, chest pain), gastrointestinal symptoms (e.g., abdominal pain, diarrhea, nausea, vomiting), and systemic symptoms (e.g., fever, weight loss, fatigue).²² The diagnostic criteria for EVALI, as defined by the CDC for a "confirmed EVALI" case, is as follows: i) individuals must have vaped within 90 days before the onset of symptoms, ii) bilateral pulmonary opacities on chest imaging, iii) a negative evaluation for infection, iv) no other plausible alternative diagnoses.²² Chest x-ray (CR) can exclude other diagnoses and is often the first imaging study. CR is not abnormal at initial assessment in all individuals with EVALI. When pulmonary abnormalities are not identified on CR or when further characterization of CR findings are needed to evaluate for another potential cause of symptoms, CT chest can be obtained.^{16,17}

References (CH-11)

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1. Expert Panel on Thoracic Imaging; Cox CW, Chung JH, et al. ACR Appropriateness Criteria® Occupational Lung Diseases. *J Am Coll Radiol*. 2020;17(5S):S188-S197. doi:10.1016/j.jacr.2020.01.022.
2. Expert Panel on Thoracic Imaging; Christensen JD, Harowicz M, et al. ACR Appropriateness Criteria® Chronic Dyspnea-Noncardiovascular Origin. 2024.
3. Bradley B, Branley HM, Egan JJ, 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 [published correction appears in *Thorax*. 2008 Nov;63(11):1029. multiple author names added]. *Thorax*. 2008;63 Suppl 5:v1-v58. doi:10.1136/thx.2008.101691.
4. Jatlaoui TC, Wiltz JL, Kabbani S, et al. Update: Interim Guidance for Health Care Providers for Managing Patients with Suspected E-cigarette, or Vaping, Product Use–Associated Lung Injury — United States, November 2019. *MMWR Morb Mortal Wkly Rep* 2019;68:1081-1086. doi:10.15585/mmwr.mm6846e2
5. Epler GR, McCloud TC, Gaensler EA, Mikus JP, Carrington CB. Normal chest roentgenograms in chronic diffuse infiltrative lung disease. *N Engl J Med*. 1978;298(17):934-939. doi: 10.1056/NEJM197804272981703.
6. Raghu G, Remy-Jardin M, Ryerson CJ, et al. Diagnosis of Hypersensitivity Pneumonitis in Adults. An Official ATS/JRS/ALAT Clinical Practice Guideline [published correction appears in *Am J Respir Crit Care Med*. 2021 Jan 1;203(1):150-151] [published correction appears in *Am J Respir Crit Care Med*. 2022 Aug 15;206(4):518]. *Am J Respir Crit Care Med*. 2020;202(3):e36-e69. doi:10.1164/rccm.202005-2032ST.
7. Expert Panel on Thoracic Imaging; Hobbs SB, Chung JH, et al. ACR Appropriateness Criteria® Diffuse Lung Disease. 1, *J Am Coll Radiol*. 2021;18(11S):S320-S329. doi:10.1016/j.jacr.2021.08.008.
8. Mathai SC, Danoff SK. Management of interstitial lung disease associated with connective tissue disease. *BMJ*. 2016;352:h6819. Published 2016 Feb 24. doi:10.1136/bmj.h6819.
9. Raghu G, Remy-Jardin M, Richeldi L, et al. Idiopathic Pulmonary Fibrosis (an Update) and Progressive Pulmonary Fibrosis in Adults: An Official ATS/ERS/JRS/ALAT Clinical Practice Guideline. *Am J Respir Crit Care Med*. 2022;205(9):e18-e47. doi:10.1164/rccm.202202-0399ST.
10. Hunninghake GM, Goldin JG, Kadoch MA, et al. Detection and early referral of patients with interstitial lung abnormalities: an expert survey initiative. *Chest*. 2022;161(2):470-482. doi:10.1016/j.chest.2021.06.035.
11. Joy GM, Arbiv OA, Wong CK, et al. Prevalence, imaging patterns and risk factors of interstitial lung disease in connective tissue disease: a systematic review and meta-analysis. *Eur Respir Rev*. 2023;32(167):220210. Published 2023 Mar 8. doi:10.1183/16000617.0210-2022.
12. Montesi SB, Fisher JH, Martinez FJ, Selman M, Pardo A, Johansson KA. Update in Interstitial Lung Disease 2019. *Am J Respir Crit Care Med*. 2020;202(4):500-507. doi:10.1164/rccm.202002-0360UP.
13. Wong AW, Ryerson CJ, Guler SA. Progression of fibrosing interstitial lung disease. *Respir Res*. 2020;21(1):32. Published 2020 Jan 29. doi:10.1186/s12931-020-1296-3.
14. Hatabu H, Hunninghake GM, Richeldi L, et al. Interstitial lung abnormalities detected incidentally on CT: a Position Paper from the Fleischner Society. *Lancet Respir Med*. 2020;8(7):726-737. doi:10.1016/S2213-2600(20)30168-5.
15. Tomassetti S, Poletti V, Ravaglia C, et al. Incidental discovery of interstitial lung disease: diagnostic approach, surveillance and perspectives [published correction appears in *Eur Respir Rev*. 2022 May 25;31(164):215206. doi: 10.1183/16000617.5206-2021]. *Eur Respir Rev*. 2022;31(164):210206. Published 2022 Apr 13. doi:10.1183/16000617.0206-2021.
16. Kligerman S, Raptis C, Larsen B, et al. Radiologic, Pathologic, Clinical, and Physiologic Findings of Electronic Cigarette or Vaping Product Use-associated Lung Injury (EVALI): Evolving Knowledge and Remaining Questions. *Radiology*. 2020;294(3):491-505. doi:10.1148/radiol.2020192585.
17. Friedman J, Schooler GR, Kwon JK, Artunduaga M. Pediatric electronic cigarette or vaping product use-associated lung injury (EVALI): updates in the coronavirus disease 2019 (COVID-19) pandemic era. *Pediatr Radiol*. 2022;52(10):2009-2016. doi:10.1007/s00247-022-05454-z.
18. Batra K, Adams TN. Imaging Features of Idiopathic Interstitial Lung Diseases. *J Thorac Imaging*. 2023;38(Suppl 1):S19-S29. doi:10.1097/RTI.0000000000000728

19. Sreedharan S, Mian M, Robertson RA, Rhodes A. Radiological findings of e-cigarette or vaping product use associated lung injury: A systematic review. *Heart Lung*. 2021;50(5):736-741. doi:10.1016/j.hrtlng.2021.05.004
20. Henry TS, Kligerman SJ, Raptis CA, Mann H, Sechrist JW, Kanne JP. Imaging Findings of Vaping-Associated Lung Injury. *AJR Am J Roentgenol*. 2020;214(3):498-505. doi:10.2214/AJR.19.22251
21. Cheng KA, Nichols H, McAdams HP, Henry TS, Washington L. Imaging of Smoking and Vaping Related Diffuse Lung Injury. *Radiol Clin North Am*. 2022;60(6):941-950. doi:10.1016/j.rcl.2022.06.004
22. Garg I, Vidholia A, Garg A, et al. E-cigarette or vaping product use-associated lung injury: A review of clinico-radio-pathological characteristics. *Respir Investig*. 2022;60(6):738-749. doi:10.1016/j.resinv.2022.06.011
23. Panse PM, Feller FF, Butt YM, et al. Pulmonary Injury Resulting from Vaping or e-Cigarette Use: Imaging Appearances at Presentation and Follow-up. *Radiol Cardiothorac Imaging*. 2020;2(4):e200081. Published 2020 Aug 27. doi:10.1148/ryct.2020200081
24. Skeoch S, Weatherley N, Swift AJ, et al. Drug-Induced Interstitial Lung Disease: A Systematic Review. *J Clin Med*. 2018;7(10):356. Published 2018 Oct 15. doi:10.3390/jcm7100356
25. Jee AS, Adelstein S, Bleasel J, et al. Role of Autoantibodies in the Diagnosis of Connective-Tissue Disease ILD (CTD-ILD) and Interstitial Pneumonia with Autoimmune Features (IPAF). *J Clin Med*. 2017;6(5):51. Published 2017 May 4. doi:10.3390/jcm6050051
26. Delaunay M, Cadranel J, Lusque A, et al. Immune-checkpoint inhibitors associated with interstitial lung disease in cancer patients. *Eur Respir J*. 2017;50(2):1700050. Published 2017 Aug 10. doi:10.1183/13993003.00050-2017
27. Tiu BC, Zubiri L, Iheke J, et al. Real-world incidence and impact of pneumonitis in patients with lung cancer treated with immune checkpoint inhibitors: a multi-institutional cohort study. *J Immunother Cancer*. 2022;10(6):e004670. doi:10.1136/jitc-2022-004670
28. Bridi GDP, Fonseca EKUN, Kairalla RA, Amaral AF, Baldi BG. Drug-induced lung disease: a narrative review. *J Bras Pneumol*. 2024 Sep 27;50(4):e20240110. doi: 10.36416/1806-3756/e20240110. PMID: 39356911; PMCID: PMC11449616.

Pneumonia and Coronavirus Disease 2019 (COVID-19) (CH-13)

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Pneumonia (CH-13.1)

CH.PN.0013.1.A

v1.0.2026

- Chest x-ray should be performed initially in all individuals with suspected pneumonia, prior to considering advanced imaging.
 - CT Chest without or with contrast (CPT® 71250 or CPT® 71260) if initial or repeat chest x-ray findings reveal:
 - complication of pneumonia (e.g., abscess, effusion, necrotizing pneumonia, pneumothorax)
 - possible lung mass associated with the infiltrate or persistent radiographic abnormalities on repeat chest x-ray after 6-8 weeks
 - CT Chest without or with contrast (CPT® 71250 or CPT® 71260) for hypoxia and/or respiratory distress
 - CT Chest without or with contrast (CPT® 71250 or CPT® 71260) after initial chest radiograph is negative or equivocal and one of the following:
 - Abnormal vital signs (including hypoxemia, pulse > 100, respiratory rate > 24, fever > 100)
 - Abnormal exam (including respiratory distress, dyspnea and or abnormal lung auscultation)
 - Advanced age (age >75), or other significant comorbidities
- If pulmonary emboli suspected, see **Pulmonary Embolism (CH-25.1)**.
- CT Chest without or with contrast (CPT® 71250 or CPT® 71260) for immunocompromised individuals with any of the following:
 - High suspicion for pneumonia despite equivocal or negative chest x-ray
 - Persistent radiographic abnormalities on repeat imaging after 6-12 weeks
 - Multiple or diffuse opacities or nodules

Evidence Discussion

Chest radiography (CR) is the appropriate first imaging modality in the evaluation of suspected pneumonia.¹⁶ The American Thoracic Society (ATS) and the Infectious Diseases Society of America (IDSA) define a clinical diagnosis of pneumonia as symptoms and signs of pneumonia with radiographic confirmation.¹ Chest radiographs should be performed for individuals with symptoms of dyspnea, tachycardia, tachypnea and fever more than 100°F or lung findings suggestive of pneumonia.²⁸

CT is more accurate/sensitive than CR and may be medically necessary when there is a high clinical suspicion for pneumonia (typical or atypical) and a delay in diagnosis could be life threatening.

CT chest without contrast is medically necessary and CT chest with contrast may be medically necessary in immunocompromised people with an acute respiratory illness and a normal/equivocal/nonspecific CR or a CR that demonstrates multiple, diffuse or confluent opacities.¹⁵

MRI is not medically necessary for the imaging of pneumonia.^{2,15} MRI has a potential role for follow up imaging of parenchymal (Chest wall/mediastinal) disease, but CT is more sensitive and is preferred.¹⁵

Ultrasound chest may be appropriate for the evaluation of parapneumonic effusions. It can also be used to guide pneumonia-related interventions.^{2,29-31}

Routine use of follow up chest imaging in adults who are improving and whose symptoms have resolved within 5-7 days is not recommended by the ATS/IDSA.¹ Repeat CR or CT after the completion of therapy is generally reserved for high risk individuals, suspected complications, disease progression or when the clinical course differs from CR interpretation.^{16,27} High risk individuals include individuals over the age of 50, smokers, and those with persistent symptoms.^{32,33} For immunocompetent individuals with suspected pneumonia, follow-up imaging within 6-12 weeks is medically necessary to confirm resolution. The follow-up imaging modality should be the same modality in which pneumonia was detected.²

Pneumonia Health Equity Considerations

Mortality from pneumonia is higher in non-Hispanic Black individuals than non-Hispanic White individuals. These disparities are the greatest in major metropolitan areas.

Coronavirus Disease 2019 (COVID-19) (CH-13.2)

CH.PN.0013.2.A

v1.0.2026

- CT Chest without contrast (CPT®71250), or with contrast (CPT®71260) is medically necessary in the following clinical situations:
 - Imaging for initial diagnosis:
 - Symptomatic COVID-19 positive individuals with underlying comorbidities (including, but not limited to, age > 65 years, chronic lung disease, current or former smoker, chronic kidney disease, chronic liver disease, dementia, diabetes, Down's syndrome, HIV or other primary, secondary or acquired immunodeficiency, mood disorders, BMI ≥30, pregnancy, solid organ or blood stem cell transplant, cerebrovascular disease, substance use disorder, tuberculosis, cardiovascular disease, malignancy, bronchopulmonary dysplasia, chronic infections, or immunocompromised state).
 - Moderate to severe symptomatic individuals with evidence of significant pulmonary dysfunction or damage (e.g., hypoxemia, moderate-to-severe dyspnea), suspected of having COVID-19, regardless of COVID-19 test results or when viral testing is not available, even with a normal chest x-ray (if done).
 - Thromboembolic complications including pulmonary embolism, stroke and mesenteric ischemia are recognized complications of COVID-19. See **Pulmonary Embolism (CH-25.1)**, **Mesenteric Ischemia (AB-6.1)** in the Abdomen Imaging Guidelines, and **Stroke/TIA (HD-21.1)** in the Head Imaging Guidelines for appropriate imaging guidance.
 - Other systemic complications are being recognized as medical knowledge about this condition evolves. Imaging for possible COVID-19 complications should be managed by the appropriate condition based guidelines.
 - Imaging after initial diagnosis:
 - Imaging in the following clinical circumstances:
 - If there is significant worsening of symptoms in a COVID-19 positive individual and imaging will be used to modify individual management.
 - A recovered COVID-19 positive individual with significant residual functional impairment and/or persistence hypoxemia.
 - Symptomatic post-COVID individuals with concern for interstitial lung disease including organizing pneumonia imaging can be considered pre and post treatment.

Evidence Discussion

Chest imaging is not medically necessary as a screening test for COVID-19 in asymptomatic people or in people with suspected COVID-19 and mild clinical features unless they are at risk for disease progression.⁷

The American College of Radiology (ACR) states that CT chest should not be used as a screen or first-line test to diagnose COVID-19.³ Viral testing is the only specific method of diagnosis and confirmation with a viral test is required even if radiologic findings on chest radiography (CR) or CT are suggestive of COVID-19.

Imaging is medically necessary in people with COVID-19 and a worsening respiratory status or in people who have suspected COVID-19, a high pretest probability of disease, and moderate to severe clinical features.⁷ Although less sensitive than CT, chest radiography (CR) is typically the first line imaging modality.^{2,7,18}

Johnston et al have proposed a management algorithm for individuals with COVID-19 pneumonia which recommends a clinical assessment with CR and PFT's 3-6 months after discharge.²³ Performance of a high resolution CT chest (HRCT) is based on risk factors (ICU admission, noninvasive or mechanical ventilation; male sex; age > 60) and serial assessment of lung function and symptoms.

There is an increased risk of pulmonary embolus (PE) in people with COVID-19, including both microvascular/ in situ thrombosis and macrothrombotic events.²⁵ It is currently recommended that the same diagnostic strategy and the same D-dimer threshold be used for people with COVID-19 and suspected PE as in those without COVID-19.^{25,26}

Background and Supporting Information

- The role of advanced imaging in the diagnosis and management of COVID-19 is very dynamic in this rapidly evolving condition.
- Comorbidities may include: chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancy; asplenia; organic brain disease (dementia, CVA, delirium).
- Findings on both Chest x-ray and CT Chest are non-specific. Chest x-rays may show patchy opacities with lower lung predominance. CT may show peripheral multifocal ground glass opacities with lower lung predominance. However, a significant portion of cases have opacities without a clear or specific distribution. A reverse halo sign or other findings of organizing pneumonia may be seen later during the course of illness. Atypical findings include isolated lobar or segmental consolidation without ground glass opacities, discrete small centrilobular ("tree-in-bud") nodules, pleural effusion.
 - Pediatric individuals may have less pronounced imaging findings than adults.
- CT Chest abnormalities are common 3 months after discharge in adults who have been hospitalized for COVID-19 and are associated with more severe acute disease.

Fibrosis was seen in a minority of people. Most people re-imaged at one year showed radiologic improvement.

- Major professional society guidelines to date:
 - The American College of Radiology (ACR) recommends that CT Chest should not be used for screening or as a first-line test to diagnose COVID-19.
 - The Centers for Disease Control and Prevention (CDC) recommends viral testing as the only specific method of diagnosis.
 - The CDC has stated that symptoms may appear 2-14 days after exposure to the virus. These symptoms may include:
 - fever or chills
 - cough
 - shortness of breath or difficulty breathing
 - fatigue
 - muscle or body aches
 - headache
 - new loss of taste or smell
 - sore throat
 - congestion or runny nose
 - nausea or vomiting
 - diarrhea
 - The Fleischner Society consensus statement published on April 7, 2020, recommends against the use of imaging in individuals with suspected COVID-19 who are either asymptomatic or have only mild symptoms without evidence of significant pulmonary dysfunction or damage (e.g., absence of hypoxemia, no or mild dyspnea).
 - According to The American Society of Transplantation, screening donors is based on methods below. Screening donors encompasses three different methods.
 - Epidemiologic screening for travel and potential exposures
 - Screening for symptoms suggestive of COVID-19
 - Viral testing (nucleic acid testing of specimens)
 - Screening asymptomatic donors with advanced imaging is not medically necessary.

References (CH-13)

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1. Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia. An official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med*. 2019;200(7):e45-e67. doi:10.1164/rccm.201908-1581ST.
2. Expert Panel on Thoracic Imaging: Batra K, Walker CM, Little BP, et al. ACR Appropriateness Criteria® Acute Respiratory Illness in Immunocompetent Patients. Updated 2024.
3. American College of Radiology. ACR Recommendations for the use of Chest Radiography and Computed Tomography (CT) for Suspected COVID-19 Infection. Available at <https://www.acr.org/advocacy/position-statements/recommendations-for-chest-radiography-and-ct-for-suspected-covid19-infection>. 3/22/2020.
4. Evaluating and Testing Persons for Coronavirus Disease 2019 (COVID-19). Centers for Disease Control and Prevention. National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases. <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/testing.html>.
5. Symptoms of Coronavirus. Centers for Disease Control and Prevention. National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases. Page last reviewed: May 13, 2020. <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>.
6. Foust AM, Phillips GS, Chu WC, et al. International Expert Consensus Statement on Chest Imaging in Pediatric COVID-19 Patient Management: Imaging Findings, Imaging Study Reporting and Imaging Study Recommendations. *Radiol Cardiothorac Imaging*. 2020;2(2):e200214. Published 2020 Apr 23. doi:10.1148/ryct.2020200214.
7. Rubin GD, Ryerson CJ, Haramati LB, et al. The Role of Chest Imaging in Patient Management During the COVID-19 Pandemic: A Multinational Consensus Statement from the Fleischner Society. *Radiology*. 2020;296(1):172-180. doi:10.1148/radiol.2020201365
8. Scott Simpson, Fernando U. Kay, Suhny Abbata, Sanjeev Bhalla, Jonathan H. Chung, Michael Chung, Travis S. Henry, Jeffrey P. Kanne, Seth Kligerman, Jane P. Ko, and Harold Litt. Radiological Society of North America Expert Consensus Statement on Reporting Chest CT Findings Related to COVID-19. Endorsed by the Society of Thoracic Radiology, the American College of Radiology, and RSNA. Published online: March 25 2020 <https://pubs.rsna.org/doi/10.1148/ryct.2020200152>
9. American Society of Transplantation: SARS-CoV-2: Recommendations and Guidance for Organ Donor Testing and Evaluation. Updated: January 18, 2023. <https://www.myast.org/sites/default/files/Donor%20Testing%20Document1.18.23.pdf>
10. Grillet F, Behr J, Calame P, Aubry S, Delabrousse E. Acute Pulmonary Embolism Associated with COVID-19 Pneumonia Detected by Pulmonary CT Angiography. *Radiology*. 2020;296(3):E186-E188. doi:10.1148/radiol.2020201544.
11. Myall KJ, Mukherjee B, Castanheira AM, et al. Persistent Post-COVID-19 Interstitial Lung Disease. An Observational Study of Corticosteroid Treatment. *Ann Am Thorac Soc*. 2021;18(5):799-806. doi:10.1513/AnnalsATS.202008-1002OC.
12. Ambardar SR, Hightower SL, Huprikar NA, Chung KK, Singhal A, Collen JF. Post-COVID-19 Pulmonary Fibrosis: Novel Sequelae of the Current Pandemic. *J Clin Med*. 2021;10(11):2452. Published 2021 Jun 1. doi:10.3390/jcm10112452.
13. Vijayakumar B, Tonkin J, Devaraj A, et al. CT Lung Abnormalities after COVID-19 at 3 Months and 1 Year after Hospital Discharge. *Radiology*. 2022;303(2):444-454. doi:10.1148/radiol.2021211746.
14. van den Borst B, Peters JB, Brink M, et al. Comprehensive Health Assessment 3 Months After Recovery From Acute Coronavirus Disease 2019 (COVID-19). *Clin Infect Dis*. 2021;73(5):e1089-1098. doi:10.1093/cid/ciaa1750.
15. Expert Panel on Thoracic Imaging, Lee C, Colletti PM, et al. ACR Appropriateness Criteria® Acute Respiratory Illness in Immunocompromised Patients. *J Am Coll Radiol*. 2019;16(11S):S331-S339. doi:10.1016/j.jacr.2019.05.019.
16. Dueck NP, Epstein S, Franquet T, Moore CC, Bueno J. Atypical pneumonia: definition, causes, and imaging features. *Radiographics*. 2021;41(3):720-741. doi:10.1148/rg.2021200131.

17. Centers for Disease Control and Prevention. Underlying Conditions and the Higher Risk for Severe COVID-19. Published July 18, 2024. <https://www.cdc.gov/covid/hcp/clinical-care/underlying-conditions.html>
18. Long B, Carius BM, Chavez S, et al. Clinical update on COVID-19 for the emergency clinician: Presentation and evaluation. *Am J Emerg Med*. 2022;54:46-57. doi:10.1016/j.ajem.2022.01.028.
19. Davis HE, McCorkell L, Vogel JM, Topol EJ. Long COVID: major findings, mechanisms and recommendations [published correction appears in Nat Rev Microbiol. 2023 Jun;21(6):408. doi: 10.1038/s41579-023-00896-0]. *Nat Rev Microbiol*. 2023;21(3):133-146. doi:10.1038/s41579-022-00846-2.
20. Cho JL, Villacreses R, Nagpal P, et al. Quantitative Chest CT Assessment of Small Airways Disease in Post-Acute SARS-CoV-2 Infection. *Radiology*. 2022;304(1):185-192. doi:10.1148/radiol.212170.
21. Singh SJ, Baldwin MM, Daynes E, et al. Respiratory sequelae of COVID-19: pulmonary and extrapulmonary origins, and approaches to clinical care and rehabilitation. *Lancet Respir Med*. 2023;11(8):709-725. doi:10.1016/S2213-2600(23)00159-5.
22. Guinto E, Gerayeli FV, Eddy RL, Lee H, Milne S, Sin DD. Post-COVID-19 dyspnoea and pulmonary imaging: a systematic review and meta-analysis. *Eur Respir Rev*. 2023;32(169):220253. Published 2023 Aug 9. doi:10.1183/16000617.0253-2022.
23. Johnston J, Dorrian D, Linden D, Stanel SC, Rivera-Ortega P, Chaudhuri N. Pulmonary Sequelae of COVID-19: Focus on Interstitial Lung Disease. *Cells*. 2023;12(18):2238. Published 2023 Sep 8. doi:10.3390/cells12182238.
24. Kramer D, Hilton R, Roman J. Pulmonary fibrosis and COVID-19. *Am J Med Sci*. 2023;366(4):245-253. doi:10.1016/j.amjms.2023.07.006.
25. Ortega-Paz L, Talasaz AH, Sadeghipour P, et al. COVID-19-Associated Pulmonary Embolism: Review of the Pathophysiology, Epidemiology, Prevention, Diagnosis, and Treatment. *Semin Thromb Hemost*. 2023;49(8):816-832. doi:10.1055/s-0042-1757634.
26. Suh YJ, Hong H, Ohana M, et al. Pulmonary Embolism and Deep Vein Thrombosis in COVID-19: A Systematic Review and Meta-Analysis. *Radiology*. 2021;298(2):E70-E80. doi:10.1148/radiol.2020203557.
27. Lampichler K. Rolle der bildgebenden Verfahren zur Abklärung von Pneumoniekomplicationen [Role of imaging procedures in clarification of complications of pneumonia]. *Radiologe*. 2017;57(1):29-34. doi:10.1007/s00117-016-0195-6.
28. Kinkade S, Long NA. Acute bronchitis. *Am Fam Physician*. 2016;94(7):560-565.
29. Desai D, Shah AB, Dela JRC, et al. Lung Ultrasonography Accuracy for Diagnosis of Adult Pneumonia: Systematic Review and Meta-Analysis. *Adv Respir Med*. 2024;92(3):241-253. Published 2024 Jun 4. doi:10.3390/arm92030024
30. Boccatonda A, Cocco G, D'Ardes D, et al. Infectious Pneumonia and Lung Ultrasound: A Review. *J Clin Med*. 2023;12(4):1402. Published 2023 Feb 10. doi:10.3390/jcm12041402
31. Chhetri KR, Chouhan APS, Singh V, Shaida B. Radio Imaging of Pneumonia: A Comprehensive Review. *J Commun Dis*. 2022;54(3):75-87. doi:10.24321/0019.5138.202292
32. Little BP, Gilman MD, Humphrey KL, et al. Outcome of recommendations for radiographic follow-up of pneumonia on outpatient chest radiography. *AJR Am J Roentgenol*. 2013;202(1):54-59. doi:10.2214/AJR.13.10888
33. Tang KL, Eurich DT, Minhas-Sandhu JK, Marrie TJ, Majumdar SR. Incidence, correlates, and chest radiographic yield of new lung cancer diagnosis in 3398 patients with pneumonia. *Arch Intern Med*. 2011;171(13):1193-1198. doi:10.1001/archinternmed.2011.155
34. Donaldson SV, Thomas AN, Gillum RF, Mehari A. Geographic Variation in Racial Disparities in Mortality From Influenza and Pneumonia in the United States in the Pre-Coronavirus Disease 2019 Era. *Chest*. 2021;159(6):2183-2190. doi:10.1016/j.chest.2020.12.029
35. Loo C, Treacy MG, Toerien L, Msellati A, Catanzano T. Emergency Presentations of Coronavirus Disease (COVID-19): A Review of the Literature and Radiologic Perspective. *Semin Ultrasound CT MR*. 2024;45(4):332-338. doi:10.1053/j.sult.2024.07.003

Other Chest Infections (CH-14)

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PPD or TB (Mycobacterium tuberculosis and Nontuberculous Mycobacterial Pulmonary Disease (NTM-PD)) (CH-14.1)

CH.CI.0014.1.A

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- CT Chest with contrast (CPT® 71260) or CT Chest without contrast (CPT® 71250) with ANY of the following:
 - Normal or equivocal chest x-ray with ONE of the following:
 - Positive PPD skin test or other positive tuberculin skin tests OR
 - Positive QuantiFERON-TB Gold OR
 - Suspected active (or reactivated) tuberculosis
 - Suspected NTM-PD (i.e., atypical mycobacterium infection, Mycobacterium avium complex (MAC))
 - 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.
 - Suspected complications or progression of tuberculosis (e.g., pleural tuberculosis, empyema, and mediastinitis)
 - For those with known TB, follow-up CT Chest with contrast (CPT® 71260) or without contrast (CPT® 71250) with frequency at the discretion of or in consultation with the pulmonary or infectious disease specialist (not to exceed 3 studies in 3 months).
 - Re-evaluate individuals undergoing active treatment who had abnormalities seen only on CT Chest.

Evidence Discussion

Nontuberculous mycobacterial pulmonary disease (NTM-PD) can be caused by a wide array of pathogens, with the most common including Mycobacterium avium complex (MAC), Mycobacterium kansasii, Mycobacterium xenopi, and Mycobacterium abscessus.

Chest radiography (CR) should be the initial imaging for suspected active M. tuberculosis (MTB) infection based on clinical symptoms and demographics, a newly positive tuberculin skin test (TST), or interferon-gamma release assay (IGRA). CT is medically necessary if CR is equivocal and there is clinical suspicion of active MTB, especially in those with impaired cell-mediated immunity.^{11,26} CT may be performed to evaluate suspected complications and monitor response to therapy.^{10,12}

CR is medically necessary to distinguish latent from active MTB in people with evidence of new exposure (a newly positive TST/IGRA or a positive TST/IGRA with unknown prior status) but no clinical symptoms.¹ The yield of CR for active MTB in the absence of clinical symptoms is low. CT is more sensitive than CR for the detection of latent TB.^{13,26} CT is recommended when CR is equivocal for active MTB or when a diagnosis of latent MTB may affect future care.^{1,14}

When a TST is not available for people who are going to live in a group home, correctional institution or nursing facility, CR is medically necessary as a surrogate screening measure.

Imaging (CR and CT) is an important component in the diagnosis and follow up of nontuberculous mycobacterial pulmonary disease (NTM-PD).¹⁶ The diagnosis and determination of response to therapy are based upon radiologic, clinical, and microbiologic criteria.^{17,18} Serial CT imaging is important for monitoring disease progression and response to therapy. Radiologic findings provide prognostic information and may affect treatment recommendations.¹⁸

Fungal Infections (Suspected or Known)

(CH-14.2)

CH.CI.0014.2.A

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- CT Chest with contrast (CPT® 71260) or High resolution CT Chest (HRCT) without contrast (CPT® 71250):
 - Initial diagnosis of any fungal pneumonia or chest infection
 - Suspected complications or progression of the fungal chest infection (e.g., worsening pneumonitis; pleural effusion, empyema, mediastinitis)
 - Suspected Allergic Bronchopulmonary Aspergillosis (ABPA) in asthmatics with atypical presentation or poor response to conventional therapy
- Follow-up CT Chest with contrast (CPT® 71260) or High Resolution CT Chest (HRCT) without contrast (CPT® 71250) with frequency at the discretion of or in consultation with the pulmonary or infectious disease specialist.
- For suspected fibrosing mediastinitis:
 - CT chest with contrast (CPT® 71260) (preferred imaging) OR
 - MRI Chest without and with contrast (CPT® 71552)
 - CTA chest (CPT® 71275) for:
 - Procedural planning
 - Evaluation of vascular stents

Evidence Discussion

Pulmonary fungal infections can be caused by a wide array of pathogens, including the endemic mycoses (*Histoplasma* species, *Blastomyces* species, and *Coccidioides* species), *Cryptococcus* species, and *Aspergillus* species.

CT chest is the imaging method of choice for suspected or known pulmonary fungal infections, especially in immunocompromised hosts.^{19,20,30} Imaging findings are not specific but can lead to early detection of infection, help direct further diagnostic procedures and narrow the differential diagnosis.^{3,20} CT is also used to monitor response to therapy and identify complications.¹⁹ The diagnosis of certain pulmonary fungal infections and determination of response to treatment require a combination of clinical, microbiologic and radiologic criteria.²¹⁻²³ Denning et al recommend follow up imaging 3-6 months after starting anti-fungal therapy for chronic pulmonary aspergillosis, then less frequently, or with any major change of clinical status based on the fact that radiologic change is slow and little change is visible on chest X-ray (CR) or CT in less than 3 months.²³

CT is not medically necessary in the routine evaluation of suspected asthma without a specific indication but may be of value to identify acute complications following a nondiagnostic CR with suspected alternative diagnoses or associated conditions, such as allergic bronchopulmonary aspergillosis.^{7,8,28,29} Serological assays can also play a role in the diagnosis of invasive pulmonary aspergillosis, including the galactomannan and beta-d glucan (Fungitell) assays.

Fibrosing mediastinitis (FM) is a rare benign but potentially life threatening process characterized by progressive proliferation of dense infiltrative fibrous tissue in the mediastinum and/or hila. Granulomatous FM is the more common subtype in the US and is typically associated with prior infection with histoplasmosis. Nongranulomatous FM is less common and is usually associated with an autoimmune disorder, drug exposure, or prior radiation. The most common symptoms are cough, dyspnea, hemoptysis, and pleuritic chest pain. Individuals may develop SVC syndrome or post-obstructive pneumonia. Widening of the mediastinum and mediastinal/hilar lymphadenopathy are the most common abnormal findings on chest x-ray. CT chest with contrast is the modality of choice for suspected FM. MRI is equivalent to CT for evaluating extent of disease, but CT is superior for evaluation of airways and calcification. PET CT is nonspecific and not routinely used. Nonsurgical and surgical procedures for individuals with clinical symptoms are related to compression or obstruction of mediastinal structures. CTA chest may be used for procedural planning or to evaluate the patency of vascular stents. There are no consensus guidelines for follow up imaging. No routine imaging is medically necessary for the granulomatous subtype unless there are progressive symptoms or clinical decompensation. Regular surveillance with CT is recommended for the nongranulomatous subtype to rule out malignancy which may not have been sampled in a biopsy.³²

Wegener's Granulomatosis/ Granulomatosis with Polyangiitis and Related Entities (CH-14.3)

CH.CI.0014.3.A

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- See **Small Vessel Vasculitis (PVD-6.11)** for concerns of Wegener's Granulomatosis and Related Entities in Peripheral Vascular Disease imaging guidelines.

Suspected Sternal Dehiscence (CH-14.4)

CH.CI.0014.4.A

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- 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 (CPT® 71250) or CT Chest with contrast (CPT® 71260) for:
 - differentiating sternal wire migration from sternal dehiscence
 - planned debridement and/or repair

See **Infection (MS-9.0)** for concerns for osteomyelitis or soft tissue infection.

Evidence Discussion

Sternal dehiscence is defined as sternal separation with intact sternal wires migrating with a displaced sternal fragment.²⁴ The diagnosis is often made clinically; however, early signs may be subtle, and it may be clinically occult.. Early detection of sternal dehiscence on chest x-ray (CR) is important.²⁴ CT may be used in equivocal cases to assess for sternal separation or for preoperative planning.^{24,25,31}

CT provides the best evaluation of sternal non-union when suspected based on pain, clicking and clinical evidence of sternal instability for > 3 months in the absence of infection.²⁴

References (CH-14)

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1. Expert Panel on Thoracic Imaging: Ravenel JG, Chung JH, et al. ACR Appropriateness Criteria® Imaging of Possible Tuberculosis. *J Am Coll Radiol*. 2017;14(5S):S160-S165. doi:10.1016/j.jacr.2017.02.022.
2. Expert Panel on Thoracic Imaging; Lee C, Colletti PM, et al. ACR Appropriateness Criteria® Acute Respiratory Illness in Immunocompromised Patients. *J Am Coll Radiol*. 2019;16(11S):S331-S339. doi:10.1016/j.jacr.2019.05.019.
3. Walker CM, Abbott GF, Greene RE, Shepard JA, Vummidi D, Digumarthy SR. Imaging pulmonary infection: classic signs and patterns [published correction appears in *AJR Am J Roentgenol*. 2014 Jun;202(6):1396]. *AJR Am J Roentgenol*. 2014;202(3):479-492. doi:10.2214/AJR.13.11463.
4. Cordier JF, Valeyre D, Guillemin L, Loire R, Brechot JM. Pulmonary Wegener's granulomatosis. A clinical and imaging study of 77 cases. *Chest*. 1990;97(4):906-912. doi:10.1378/chest.97.4.906.
5. Peivandi AA, Vogel N, Opfermann UT, et al. Early detection of sternal dehiscence by conventional chest X-ray. *Thorac Cardiovasc Surg*. 2006;54(2):108-111. doi:10.1055/s-2005-872864.
6. Kumar K, Loebinger MR. Nontuberculous Mycobacterial Pulmonary Disease: Clinical Epidemiologic Features, Risk Factors, and Diagnosis: The Nontuberculous Mycobacterial Series. *Chest*. 2022;161(3):637-646. doi:10.1016/j.chest.2021.10.003.
7. Ash SY, Diaz AA. The role of imaging in the assessment of severe asthma. *Curr Opin Pulm Med*. 2017;23(1):97-102. doi:10.1097/MCP.0000000000000341.
8. Richards JC, Lynch D, Koelsch T, Dyer D. Imaging of Asthma. *Immunol Allergy Clin North Am*. 2016;36(3):529-545. doi:10.1016/j.iac.2016.03.005.
9. Hota P, Dass C, Erkmén C, Donuru A, Kumaran M. Poststernotomy Complications: A Multimodal Review of Normal and Abnormal Postoperative Imaging Findings. *AJR Am J Roentgenol*. 2018;211(6):1194-1205. doi:10.2214/AJR.18.19782.
10. Nel M, Franckling-Smith Z, Pillay T, Andronikou S, Zar HJ. Chest Imaging for Pulmonary TB-An Update. *Pathogens*. 2022;11(2):161. Published 2022 Jan 26. doi:10.3390/pathogens11020161.
11. Wetscherek MTA, Sadler TJ, Lee JYJ, Karia S, Babar JL. Active pulmonary tuberculosis: something old, something new, something borrowed, something blue. *Insights Imaging*. 2022;13(1):3. Published 2022 Jan 9. doi:10.1186/s13244-021-01138-8.
12. Expert Panel on Thoracic Imaging: Batra K, Walker CM, Little BP, et al. ACR Appropriateness Criteria® Acute Respiratory Illness in Immunocompetent Patients. Updated 2024.
13. Moore N, Maher M, Murphy G, O'Callaghan Maher M, O'Connor OJ, McEntee MF. CT in the detection of latent tuberculosis: a systematic review. *Clin Radiol*. 2023;78(8):568-575. doi:10.1016/j.crad.2023.04.014.
14. Piccazzo R, Paparo F, Garlaschi G. Diagnostic accuracy of chest radiography for the diagnosis of tuberculosis (TB) and its role in the detection of latent TB infection: a systematic review. *J Rheumatol Suppl*. 2014;91:32-40. doi:10.3899/jrheum.140100.
15. WHO consolidated guidelines on tuberculosis: Module 2: screening - systematic screening for tuberculosis disease. Geneva: World Health Organization; 2021.
16. Lipman M, Cleverley J, Fardon T, et al. Current and future management of non-tuberculous mycobacterial pulmonary disease (NTM-PD) in the UK. *BMJ Open Respir Res*. 2020;7(1):e000591. doi:10.1136/bmjresp-2020-000591.
17. Daley CL, Iaccarino JM, Lange C, et al. Treatment of nontuberculous mycobacterial pulmonary disease: an official ATS/ERS/ESCMID/IDSA clinical practice guideline. *Eur Respir J*. 2020;56(1):2000535. Published 2020 Jul 7. doi:10.1183/13993003.00535-2020.
18. Haworth CS, Banks J, Capstick T, et al. British Thoracic Society guidelines for the management of non-tuberculous mycobacterial pulmonary disease (NTM-PD). *Thorax*. 2017;72(Suppl 2):ii1-ii64. doi:10.1136/thoraxjnl-2017-210927.
19. Alexander BD, Lamothe F, Heussel CP, et al. Guidance on Imaging for Invasive Pulmonary Aspergillosis and Mucormycosis: From the Imaging Working Group for the Revision and Update of the Consensus Definitions of Fungal Disease from the EORTC/MSGERC. *Clin Infect Dis*. 2021;72(Suppl 2):S79-S88. doi:10.1093/cid/ciaa1855.

20. Lewis RE, Stanzani M, Morana G, Sassi C. Radiology-based diagnosis of fungal pulmonary infections in high-risk hematology patients: are we making progress?. *Curr Opin Infect Dis.* 2023;36(4):250-256. doi:10.1097/QCO.0000000000000937.
21. Van Braeckel E, Page I, Davidsen JR, et al. Treatment outcome definitions in chronic pulmonary aspergillosis: a CPAnet consensus statement. *Eur Respir J.* 2022;59(6):2102950. Published 2022 Jun 9. doi:10.1183/13993003.02950-2021.
22. Setianingrum F, Rautemaa-Richardson R, Denning DW. Pulmonary cryptococcosis: A review of pathobiology and clinical aspects. *Med Mycol.* 2019;57(2):133-150. doi:10.1093/mmy/myy086.
23. Denning DW, Cadranell J, Beigelman-Aubry C, et al. Chronic pulmonary aspergillosis: rationale and clinical guidelines for diagnosis and management. *Eur Respir J.* 2016;47(1):45-68. doi:10.1183/13993003.00583-2015.
24. Hota P, Dass C, Erkmén C, Donuru A, Kumaran M. Poststernotomy Complications: A Multimodal Review of Normal and Abnormal Postoperative Imaging Findings. *AJR Am J Roentgenol.* 2018;211(6):1194-1205. doi:10.2214/AJR.18.19782.
25. Silverborn M, Heitmann LA, Sveinsdottir N, Rögnvaldsson S, Kristjánsson TT, Guðbjartsson T. Non-infectious sternal dehiscence after coronary artery bypass surgery. *J Cardiothorac Surg.* 2022;17(1):249. Published 2022 Oct 3. doi:10.1186/s13019-022-02015-1.
26. Anjos LRBD, Parriera PL, Torres PPTS, Kipnis A, Junqueira-Kipnis AP, Rabahi MF. Non-tuberculous mycobacterial lung disease: a brief review focusing on radiological findings. *Rev Soc Bras Med Trop.* 2020;53:e20200241. Published 2020 Sep 11. doi:10.1590/0037-8682-0241-2020
27. Nguyen I, Green O, Modahl L. Nontuberculous Mycobacterial Pulmonary Disease: A Clinical and Radiologic Update. *Semin Roentgenol.* 2022;57(1):75-89. doi:10.1053/j.ro.2021.10.008
28. Godet C, Brun AL, Couturaud F, et al. CT Imaging Assessment of Response to Treatment in Allergic Bronchopulmonary Aspergillosis in Adults With Bronchial Asthma. *Chest.* 2024;165(6):1307-1318. doi:10.1016/j.chest.2024.02.026
29. Agarwal R, Muthu V, Sehgal IS, Dhoria S, Prasad KT, Aggarwal AN. Allergic Bronchopulmonary Aspergillosis. *Clin Chest Med.* 2022;43(1):99-125. doi:10.1016/j.ccm.2021.12.002
30. Azar MM. A Diagnostic Approach to Fungal Pneumonia: An Infectious Diseases Perspective. *Chest.* 2024;165(3):559-572. doi:10.1016/j.chest.2023.10.005
31. Shirke MM, Dominic C, Debnath P, et al. Computed Tomography Scanning for Sternal Wound Infections: A Systematic Review. *Ulster Med J.* 2024;92(3):139-147.
32. Garrana SH, Buckley JR, et al. Multimodality Imaging of focal and diffuse fibrosing mediastinitis. *Radiographics* 2019; 39(3): 651-667.
33. Tabotta F, Ferretti GR, Prosch H, et al. Imaging features and differential diagnoses of non-neoplastic diffuse mediastinal diseases. *Insights Imaging.* 2020;11(1):111. Published 2020 Oct 15. doi:10.1186/s13244-020-00909-z

Sarcoid (CH-15)

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Sarcoid (CH-15.1)

CH.SA.0015.1.A

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- CT Chest with contrast (CPT® 71260) or without contrast (CPT® 71250) is medically necessary to:
 - Establish or rule out the diagnosis when suspected
- Subsequent CT Chest with contrast (CPT® 71260) or without contrast (CPT® 71250), in known sarcoidosis, for ANY of the following:
 - Development of worsening symptoms
 - New symptoms appear after a period of being asymptomatic
 - Treatment change is being considered
- If CT is equivocal, definitive diagnosis can only be made by biopsy.
- PET/CT should not be used in the standard work-up of all sarcoidosis individuals. There is currently no evidence to support the use of PET/CT for screening.
- PET/CT (CPT® 78815) is medically necessary under the following conditions:
 - Help guide biopsy location if:
 - known lesion on CT Chest is difficult to access, to help identify alternative biopsy location
 - no apparent lung involvement and to identify an extrapulmonary biopsy site
 - Differentiation of reversible granulomatous disease from irreversible pulmonary fibrosis and will affect treatment options
 - Help identify treatment failure where either current treatment will be modified or new treatment will be introduced

Evidence Discussion

Sarcoidosis is a multisystem disease of unknown etiology characterized by the formation of noncaseating granulomas in various organs.⁴ The diagnosis is based on three major criteria: a compatible clinical presentation, the finding of nonnecrotizing granulomatous inflammation in a tissue sample, and the exclusion of alternative causes of granulomatous disease.⁵ Imaging plays an important role in the diagnosis. Although chest x-ray (CR) is often the first imaging test used, high resolution chest CT (HRCT) is more sensitive than CR for the detection of nodules and subtle fibrosis.⁴ Histologic examination of tissue remains the gold standard for reaching a definitive diagnosis.⁶ However, in the appropriate clinical context, certain patterns of mediastinal and parenchymal involvement on HRCT are virtually diagnostic of sarcoidosis.⁶ The American Thoracic Society (ATS) states that if asymptomatic bilateral hilar lymphadenopathy is found on chest imaging, histologic confirmation is not always required.⁵

The monitoring of individuals with pulmonary sarcoidosis is not standardized. Changes in imaging along with clinical features have been used to assess changes in disease activity.⁷ If spirometry and pulmonary symptoms are worsening, additional chest imaging may be useful to detect progression of pulmonary disease or an alternative diagnosis.⁸ HRCT can also provide prognostic information by differentiating reversible from irreversible (i.e., fibrotic) lesions and show complications, such as mycetomas or evidence of pulmonary hypertension.⁶

There is interest in the use of FDG PET CT for the diagnosis and monitoring of sarcoidosis. PET CT may reveal a more easily accessible biopsy site which is not clinically evident.^{4,7} It may detect multi-organ and/or extra-thoracic involvement and demonstrate active inflammation not easily recognized by physical exam or other methods.^{7,9} Studies have shown that FDG uptake in sarcoidosis represents active granulomatous inflammation.⁷ The evaluation of disease activity is valuable when there is doubt regarding the activity of lesions and a change in therapy is being considered.⁶ Positive scans should be interpreted with caution, however, because FDG uptake can be present in other inflammatory processes and malignancy. A significant correlation between decreased metabolic activity in the lungs, increased pulmonary function tests and improved symptoms in response to immunosuppressive medication has been demonstrated.^{7,9} Most of the data regarding PET CT and sarcoidosis come from retrospective studies. Prospective trials are needed to determine the role of PET CT in monitoring the efficacy of therapy and the importance of abnormal PET CT's in asymptomatic individuals.⁹ The threshold SUV that distinguishes active disease from fibrosis has not been determined. Few studies have compared the value of HRCT vs PET CT for diagnosis. Data on appropriate time intervals for follow up assessments and the role of PET-guided therapy are scarce.⁹

Sarcoid Health Equity Considerations

- Sarcoidosis occurs 2.5 times more often in Black individuals and females.
- Individuals who are Black, female, and/or have a low socioeconomic status report lower health-related quality of life, as well as increased rates of symptoms, mortality, and hospitalizations related to sarcoidosis.
- The unequal distribution of care and resources between rural/urban locations and different states may impact the quality of care and health outcomes related to sarcoidosis.

References (CH-15)

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1. Sarcoidosis. foundation. chestnet.org. <https://foundation.chestnet.org/lung-health-a-z/sarcoidosis/>
2. Akaike G, Itani M, Shah H, et al. PET/CT in the Diagnosis and Workup of Sarcoidosis: Focus on Atypical Manifestations. *Radiographics*. 2018;38(5):1536-1549. doi:10.1148/rg.2018180053
3. Teirstein AS, Machac J, Almeida O, Lu P, Padilla ML, Iannuzzi MC. Results of 188 whole-body fluorodeoxyglucose positron emission tomography scans in 137 patients with sarcoidosis. *Chest*. 2007;132(6):1949-1953. doi:10.1378/chest.07-1178.
4. Sève P, Pacheco Y, Durupt F, et al. Sarcoidosis: A Clinical Overview from Symptoms to Diagnosis. *Cells*. 2021;10(4):766. Published 2021 Mar 31. doi:10.3390/cells10040766.
5. Crouser ED, Maier LA, Wilson KC, et al. Diagnosis and Detection of Sarcoidosis. An Official American Thoracic Society Clinical Practice Guideline. *Am J Respir Crit Care Med*. 2020;201(8):e26-e51. doi:10.1164/rccm.202002-0251ST.
6. Tana C, Donatiello I, Coppola MG, et al. CT Findings in Pulmonary and Abdominal Sarcoidosis. Implications for Diagnosis and Classification. *J Clin Med*. 2020;9(9):3028. Published 2020 Sep 20. doi:10.3390/jcm9093028.
7. Keijsers RGM, Grutters JC. In Which Patients with Sarcoidosis Is FDG PET/CT Indicated?. *J Clin Med*. 2020;9(3):890. Published 2020 Mar 24. doi:10.3390/jcm9030890.
8. Gupta R, Judson MA, Baughman RP. Management of Advanced Pulmonary Sarcoidosis. *Am J Respir Crit Care Med*. 2022;205(5):495-506. doi:10.1164/rccm.202106-1366CI.
9. Vender RJ, Aldahham H, Gupta R. The role of PET in the management of sarcoidosis. *Curr Opin Pulm Med*. 2022;28(5):485-491. doi:10.1097/MCP.0000000000000892.
10. Régis C, Benali K, Rouzet F. FDG PET/CT Imaging of Sarcoidosis. *Semin Nucl Med*. 2023;53(2):258-272. doi:10.1053/j.semnuclmed.2022.08.004
11. Li Y, Xu G. Diagnostic Value of Imaging and Serological Biomarkers in Pulmonary Sarcoidosis. *Adv Respir Med*. 2024;92(3):190-201. Published 2024 Apr 28. doi:10.3390/arm92030020
12. Pasini RA, Al-Ani MAZ, Altmayer S, et al. Multimodality Imaging for the Diagnosis and Evaluation of Pulmonary Sarcoidosis. *Radiol Cardiothorac Imaging*. 2025;7(2):e240294. doi:10.1148/ryct.240294
13. Calandriello L, D'Abronzio R, Pasciuto G, et al. Novelty in Imaging of Thoracic Sarcoidosis. *J Clin Med*. 2021;10(11):2222. Published 2021 May 21. doi:10.3390/jcm10112222
14. Thillai M, Atkins CP, Crawshaw A, et al. BTS Clinical Statement on pulmonary sarcoidosis [published correction appears in *Thorax*. 2021 Jul;76(7):e4. doi: 10.1136/thoraxjnl-2019-214348corr1.]. *Thorax*. 2021;76(1):4-20. doi:10.1136/thoraxjnl-2019-214348
15. Sharp M, Eakin MN, Drent M. Socioeconomic determinants and disparities in sarcoidosis. *Curr Opin Pulm Med*. 2020;26(5):568-573. doi:10.1097/MCP.0000000000000704
16. Obi ON, Sharp M, Harper L. Progress for all: addressing disparities in sarcoidosis. *Curr Opin Pulm Med*. 2024;30(5):551-560. doi:10.1097/MCP.0000000000001104
17. Obi ON. Diversity and disparity in the treatment and care of sarcoidosis. *Curr Opin Pulm Med*. 2023;29(5):512-524. doi:10.1097/MCP.0000000000000994

Solitary Pulmonary Nodule (SPN) (CH-16)

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Solitary Pulmonary Nodule (CH-16.0)

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- For Lung Cancer Screening (LDCT) including incidental findings from LDCT, See **Lung Cancer Screening (CH-33)**

Solitary Pulmonary Nodule – Imaging

(CH-16.1)

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- For these guidelines, manual nodule measurements should be based on the average of long- and short-axis diameters. The size threshold (<6mm) corresponds to a rounded measurement of 5mm or less in these guidelines. Measurements should be rounded to the nearest millimeter. Prediction models used to estimate malignancy yield better results with the average diameter than with the maximum transverse diameter. The dimension of small pulmonary nodules (<10mm) should be expressed as the average of the maximal long-axis and perpendicular maximal short-axis measurements in the same plane. For larger nodules and for masses larger than 10mm, it is generally appropriate to record both long- and short-axis dimensions, with the long-axis dimension being used to determine the T factor in lung cancer staging and being a criterion for tumor response to treatment.
- A pulmonary nodule can be determined to have changed in size when its average diameter has increased or decreased by at least 2mm (rounded to the nearest millimeter). Smaller changes do not reliably indicate change.
- Maximum intensity projection (MIP), and Minimum intensity projection (MinIP) are 2D projections of the volumetric (3D) acquisition data. These projections may be of use in evaluation of pulmonary nodules, but these projections are included in the cross sectional imaging base codes, and is not separately reimbursable.
- EITHER CT Chest with contrast (CPT® 71260) OR CT Chest without contrast (CPT® 71250) is medically necessary 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 or MRI Chest. Examples of other studies:
 - Chest x-ray
 - CT abdomen
 - MRI spine
 - Coronary CTA (unless full lung field are noted to be included)
 - But NOT in the following which are considered initial dedicated advanced chest imaging:
 - CT Chest without and with contrast (CPT® 71270)
 - CTA Chest (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.
 - 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 **Incidental Pulmonary Nodules Detected on CT Images (CH-16.2)**, and **Pleural-Based Nodules and Other Abnormalities (CH-17.1)**)
- A lung nodule is defined as an approximately rounded opacity (more or less well-defined) measuring up to 3cm in diameter.
- Rounded lesions measuring more than 3cm in diameter are termed lung masses and should be considered indicative of lung cancer until histologically proven otherwise. Approach to lung masses differ from that of nodules and these guidelines are specifically for those abnormalities, occurring within the chest, that meet the definition of a pulmonary nodule(s).

Evidence Discussion

A pulmonary nodule is defined as a well or poorly defined rounded opacity < 3cm in diameter. Focal pulmonary lesions > 3cm are considered masses. Nodule measurement is currently determined by standard linear measurement with electronic calipers. Measurements and averages should be expressed to the nearest whole millimeter. The dimension of small pulmonary nodules (<10mm) should be expressed as the average of the maximal long-axis and perpendicular maximal short-axis measurements in the same plane. For larger nodules and masses, both long- and short-axis dimensions should be recorded.¹⁰ Semi-automated nodule volumetry has superior sensitivity for detecting growth and is recommended as the preferred method by the British Thoracic Society (BTS), but it requires dedicated software and is currently not widely used in clinical practice.^{10,12} Nodule growth is defined as an increase of > 1.5mm (> 2 mm³) by the Lung-RADS criteria, greater than or equal to 2mm change in average diameter by the Fleischner criteria or an increase of at least 25% in volume by the BTS.^{1,12,14} A number of studies have established the advantage of post-processing 3D CT techniques, such as maximum intensity projection (MIP), minimum intensity projection (MinIP) and volume rendering (VR) in the detection and assessment of pulmonary nodules.^{9,12,15}

If an indeterminate nodule is seen on a CR or CT, prior studies should be reviewed to determine possible growth or stability, including comparison with the earliest available study and more recent ones.¹⁻³ If stability of a nodule seen on CR cannot be determined, CT chest is appropriate.^{2,3} CT is the modality of choice to evaluate pulmonary nodules.³ Intravenous contrast is not required to identify or characterize nodules.¹⁸ The size of the nodule is crucial for determining the appropriate timing of follow up surveillance imaging.¹

For nodules which are detected incidentally on incomplete thoracic CT scans (e.g., cardiac, neck, spine or abdominal CT), the Fleischner society recommends no follow up for most nodules < 6mm based on the estimated low risk of malignancy. The ACR states that an optional follow up CT may be done at 12 months for nodules < 6mm with a suspicious morphology and/or upper lobe location.³ For nodules 6-8mm, Fleischner and ACR guidelines recommend a CT chest after the appropriate interval (3-12 months, depending on clinical risk). For a nodule > 8mm or a very suspicious nodule, an immediate CT chest is recommended.^{1,3}

Background and Supporting Information

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

Incidental Pulmonary Nodules Detected on CT Images (CH-16.2)

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Solid Pulmonary Nodules

- These time intervals refer to the time from initial detection of the nodule(s).

Incidentally Detected Solid Pulmonary Nodules Follow-up Recommendations				
Nodule Type	<6mm (<100 mm ³)	6–8mm	>8mm	Comments
Single Nodule	Follow-up (optional) CT at 12 months. No routine follow-up if stable at 12 months	CT at 6–12 months, then CT at 18–24 months if stable *For an 8mm solid nodule PET request, see CH-16.4	CT at 3 months, then CT at 6–12 and then at 18–24 months if stable. Consider PET/CT* or biopsy	Certain individuals at high-risk with suspicious nodule morphology, upper lobe location, or both may warrant 12-month follow-up
Multiple Nodules	Follow-up (optional) CT at 12 months. *No routine follow-up if stable at 12 months	CT at 3–6 months, then at 18–24 months if stable	CT at 3–6 months, then at 18–24 months if stable. Consider PET/CT* or biopsy	Use most suspicious nodule as a guide to management. Follow-up intervals may vary according to size and risk.

- *PET/CT consider for ≥8mm solid lung nodule or solid component of a sub-solid nodule, not for groundglass opacity.
- Follow-up indications after PET/CT:

- If a PET/CT was found to be negative, follow-up with CT at 3 months, 9 months, and 21–24 months, if stable.
- If a PET/CT was found to be positive, a biopsy was negative, non-diagnostic, or biopsy not performed, follow-up with CT at 3 months, 9–12 months, and 24 months, if stable.
- These criteria are not intended for use in the following groups:
 - Individuals aged 35 years or younger
 - Considered to have an overall low risk for pulmonary malignancy
 - In this age group, nodules are most likely to be infectious rather than cancer
 - Management of incidentally-found pulmonary nodules in this group should be individualized
 - Known primary cancer with risks for metastases
 - Immunocompromised individuals at risk for infection

Sub-Solid Pulmonary Nodules

- These time intervals refer to the time from initial detection of the nodule(s).

Incidentally Detected Sub-Solid Pulmonary Nodules Follow-up Recommendations			
Nodule Type	<6mm (<100mm ³)	≥6mm (≥100mm ³)	Comments
Single Ground glass opacity (GGO)	Consider follow-up at 2 and 4 years. If solid component(s) or growth develops, consider resection.	CT at 6–12 months to confirm persistence, then follow-up with CT every 2 years until 5 years	In certain suspicious nodules, <6mm, consider follow-up at 2 and 4 years. If solid component(s) or growth develops, consider resection.

Incidentally Detected Sub-Solid Pulmonary Nodules Follow-up Recommendations

Single Sub-solid	Consider follow-up at 2 and 4 years. If growth develops, consider resection.	CT at 3–6 months to confirm persistence. If unchanged and solid component remains <6mm, then annual CT should be performed for 5 years. If the solid component has suspicious morphology (i.e., lobulated margins or cystic components), is >8mm or is growing: Consider PET/CT* or biopsy	In practice, part-solid nodules cannot be defined as such until ≥6mm. Persistent part-solid nodules with solid components ≥6mm should be considered highly suspicious.
Multiple Sub-Solid	CT at 3–6 months. If stable, consider CT at 2 and 4 years.	CT at 3–6 months. Subsequent management based on the most suspicious nodule(s).	Multiple <6mm pure ground-glass nodules are usually benign.

- *PET/CT consider for ≥8mm solid lung nodule or solid component of a sub-solid nodule, not for groundglass opacity.
- Follow-up indications after PET/CT:
 - If a PET/CT was found to be negative, follow-up with CT at 3 months, 9 months, and 21–24 months, if stable.
 - If a PET/CT was found to be positive, a biopsy was negative, non-diagnostic, or biopsy not performed, follow-up with CT at 3 months, 9-12 months, and 24 months, if stable.
- These criteria are not intended for use in the following groups:
 - Individuals aged 35 years or younger
 - Considered to have an overall low risk for pulmonary malignancy
 - In this age group, nodules are most likely to be infectious rather than cancer
 - Management of incidentally-found pulmonary nodules in this group should be individualized
 - Known primary cancer with risks for metastases

- Immunocompromised individuals at risk for infection
- Sub-solid nodules may either be a part-solid nodule, comprising of both solid and ground glass components or a pure ground glass nodule, the latter may also be referred to as "non-solid".
 - Follow-up after year 5 is medically necessary every 2-4 years for at least 10 years if requested.
- For pulmonary nodule follow-up studies a CT Chest without IV contrast (CPT® 71250) is medically necessary. IV contrast is medically necessary as requested.

Pulmonary Cyst(s)

- May represent a rare form of adenocarcinoma, squamous cell carcinoma, or small cell carcinoma.
- Short-term initial imaging to exclude rapid growth is medically necessary at 3-6 months.
- Further imaging can be managed according to the sub-solid pathway above.

Endobronchial Lesion

- CT chest without contrast (CPT® 71250) at 3 months to confirm resolution or persistence
- If persistent, direct visualization with bronchoscopy is medically necessary

Evidence Discussion

A pulmonary nodule is defined as a well or poorly defined rounded opacity < 3cm in diameter. The Fleischner Society guidelines for the management of incidental pulmonary nodules detected on CT were last updated in 2017.¹ The purpose of the guidelines is to minimize both the number of unnecessary follow up exams and the chance of a malignancy advancing in stage during CT follow up prior to diagnosis. Surveillance is most appropriate if there is a very low probability of cancer or a high risk of complications from surgery or biopsy.² It is important to establish the clinical probability of malignancy before ordering imaging.^{1,2,12} The Fleischner guidelines are not intended to apply to people younger than 35, people with known primary cancers at risk of metastases or to immunocompromised people at risk of infection. They do not apply to individuals with unexplained fever or respiratory symptoms.³ For individuals younger than 35, lung cancer is rare. Management should be on a case by case basis, and the use of serial CT's should be minimized.¹

Solid nodules < 6mm do not require follow up in individuals at low risk of lung cancer or in all individuals at high risk. Nodules which have a suspicious morphology or an upper lobe location may be followed up with a CT in 12 months. Solid nodules 6-8mm may be followed with a CT at 6-12 months in low risk individuals with a further follow up at 18-24 months in high risk individuals. Two follow up CT's should be sufficient to rule out growth in most individuals.

For solid nodules >8 mm, the options are CT surveillance, an FDG PET/CT, tissue sampling or a combination of these. Surveillance CT scans for solid nodules >8 mm may be done at 3 months, 6-12 months and 18-24 months.¹ The American College of Chest Physicians (ACCP) guidelines recommend a PET/CT or nonsurgical biopsy for solid nodules of at least 8mm when the pretest probability of malignancy is low to moderate.² The pretest probability affects the interpretation of PET/CT results: high risk individuals are at risk of false negative results and low risk individuals are at risk of false positive results.¹² If there is a high pretest probability of cancer, a negative PET/CT does not reliably rule out cancer and either continued surveillance for at least 2 years or tissue sampling is advised.^{2,13} The ACCP states that the optimal interval for surveillance CT's for solid nodules >8mm is not determined, but standard practice is 3-6 months, 9-12 months and 18-24 months. They suggest surveillance with CT if the clinical probability of cancer is very low, the clinical probability of malignancy is low and a PET CT is negative, a PET CT is negative and a needle biopsy is non-diagnostic, or an informed individual prefers a non-aggressive approach. If a solid nodule shows clear growth on serial CT's, a non-surgical biopsy or surgical resection is recommended unless there are specific contraindications.² A surgical diagnosis is recommended if there is a high clinical probability of lung cancer, the nodule is intensely hypermetabolic on PET/CT, a non-surgical biopsy is suspicious for cancer or an individual prefers a definitive diagnosis.²

Multiple solid nodules <6mm are usually benign, representing granulomas or intrapulmonary lymph nodes. A 12 month follow up CT may be considered in high risk individuals. If there is clinical evidence of infection or the individual is immunocompromised, infection should be considered. A short term follow CT may be appropriate. Multiple solid nodules with at least one nodule greater than or equal to 6 mm can be followed with CT's at 3-6 months and 18-24 months. Management should be based on the largest/most suspicious nodule. Most metastases will grow over 3 months. The risk of cancer increases as the number of nodules increases from 1 to 4 but decreases if the number is greater than 4.

Subsolid nodules (SSN) include pure ground glass nodules (GGN) and part-solid nodules (PSN). SSN are more likely to be malignant than solid nodules but have a better prognosis than lung cancers which present as solid nodules.¹² Many have slow growth rates and may remain stable for years. Pure GGN < 6mm do not require routine follow up. However, this should not preclude the option of follow up CT's at 2 and 4 years in high risk individuals. GGN greater than or equal to 6mm can be followed at 6-12 months and then every two years until 5 years. The Fleischner Society states that these guidelines are not intended to preclude either shorter or longer term follow up in individuals when deemed clinically appropriate. A previous study found growth in 7% of part-solid nodules that had previously been stable for 3 years, and another study found growth >2mm in 13% of nodules after 5 years of stability.²¹ The ACCP states there is controversy regarding how long to follow part solid or ground glass nodules and

that follow up over several years may be appropriate. In appropriate individuals, follow-up after 5 years, every 2-4 years, can be considered for at least 10 years, taking into account comorbidities, life expectancy, and individual preferences.²¹

Solitary PSN < 6mm do not require routine follow up. A follow up CT may be done at 2 and 4 years. For PSN greater than or equal to 6mm with a solid component < 6mm, a follow up CT may be done at 3-6 months and then annually for a minimum of 5 years. The 5 year period is somewhat arbitrary but considered reasonable if the nodule is unequivocally stable during that time period. If the solid component is at least 6mm, follow up at 3-6 months should be done. A persistent PSN with a solid component of at least 6mm or a growing solid component is highly suspicious. If the nodule has suspicious morphology, if the solid component is growing or > 8mm, PET/CT or biopsy should be considered.^{1,12} Multiple PSN < 6mm are often infectious. A repeat CT can be done at 3-6 months, then at 2 and 4 years. If at least one of the nodules is greater than or equal to 6mm, a repeat CT can be done at 3-6 months, and management should be based on the most suspicious nodule.

The volume of lung nodules is significantly larger in CT chest with contrast compared to CT chest without contrast. Whichever CT protocol is used initially should also be used in all follow-up scans to avoid the risk of missing any relevant nodule growth.^{24,25}

Pulmonary cystic lesions may represent a cyst-related primary lung malignancy. There are no uniform surveillance criteria for these lesions, but some authors recommend a CT at 3-6 months to exclude rapid growth and then follow up CT's according to the SSN nodule guidelines.⁸

NCCN guidelines for the management of incidental pulmonary nodules are consistent with the Fleischner guidelines.^{6,7} For pulmonary nodules detected on lung cancer screening CT's, adherence to the American College of Radiology (ACR) Lung-RADS guidelines is recommended.^{1,3,6,7,14} The British Thoracic Society and ACCP guidelines do not distinguish the management of screening-detected nodules from nodules detected incidentally.^{2,12}

Interval Imaging Outcomes (CH-16.3)

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- Further advanced imaging is not medically necessary if nodule(s) ANY of the following:
 - Has remained stable as described in **CH-16.2: Incidental Pulmonary Nodules Detected on CT Images**
 - 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.
- For clinically significant lung nodule(s) (lung nodules not meeting the above criteria) which increase in size or number, serial CT screening or surveillance are not medically necessary.
 - In individuals who do not meet PET criteria (per CH-16.4) or in individuals in which biopsy is not being considered, serial CT may be performed per CH-16.2.

Evidence Discussion

If a chest x-ray (CR) or chest CT has demonstrated that a pulmonary nodule has benign characteristics, further imaging is not medically necessary. Benign characteristics include intranodular fat or a diffuse, central, laminated or popcorn pattern of calcification.²

If an indeterminate nodule is seen on a CR or CT, prior studies should be reviewed to determine possible growth or stability, including comparison with the earliest available study and more recent ones.¹⁻³ If stability of a nodule seen on CR cannot be determined, CT chest is appropriate.^{2,3} If a solid nodule has been stable for at least 2 years, no additional evaluation is necessary.² Two years of radiographic stability is considered strong presumptive evidence of a benign nodule. For solid nodules seen on CT, further follow up is not needed if nodules <6mm have been stable for one year or if nodules greater than or equal to 6mm have been stable for two years.¹ Malignant nodules show a wide range of growth rates with some demonstrating regression at times. Solid nodules greater than or equal to 6mm that decrease in size but do not completely resolve should be followed to resolution or lack of growth over 2 years.^{2,12} For situations where PET, CT, and/or biopsy are not reasonable choices, ongoing surveillance would be medically necessary. Clinically significant nodules that are not amendable to PET and/or biopsy may undergo serial CT exams per CH-16.2.

There is controversy regarding how long to follow part solid or ground glass nodules. Follow up over several years may be appropriate.² The Fleischner guidelines state that

subsolid nodules <6mm may be followed for up to 4 years but that the guidelines are not intended to preclude either shorter or longer term follow up in individuals when deemed clinically appropriate.¹ Subsolid nodules greater than or equal to 6mm may be followed for 5 years. The 5 year period is "somewhat arbitrary but considered reasonable if the nodule is unequivocally stable during that time period."¹

PET/CT should be considered for solid nodules greater than or equal to 8mm.^{1,2} If a solid nodule shows clear growth on serial CT's, a non-surgical biopsy or surgical resection is recommended unless there are specific contraindications.² Non-solid nodules which grow or develop solid components are often malignant and further evaluation and/or resection should be considered.^{2,14}

If a CT demonstrates multiple solid nodules <6mm and there is clinical evidence of infection or the individual is immunocompromised, infection should be considered and a short term follow up CT may be appropriate.¹ Certain findings on a lung cancer screening CT which suggest an infectious or inflammatory process (e.g., >6 new nodules or solid nodules which are greater than or equal to 8mm appearing in a short interval) are reported as Lung-RADS 0 and may be followed up with a LDCT in 1-3 months.¹⁴ Some findings indicative of an infectious/inflammatory process may not warrant short-term follow-up (e.g., tree-in-bud nodules or new <3cm ground glass nodules).

Background and Supporting Information

- Approximately 20% of observed cancers have decreased in size at least at some point during their observation period. Therefore, a decreasing size of a nodule cannot be a reliable indicator of being benign.
- For nodules that increase in number, this is not meant for known stable or benign nodules to be counted.
- Example, known 4mm nodule stable for 3 years, now presents with a new solid 8mm pulmonary nodule, follow-up will be driven by new nodule size and type.
- Example #2, known granuloma 5mm from prior CT Chest one year ago and now CT Chest reveals a new 6mm sub-solid nodule, follow-up would be driven by the new nodule size and type.

PET (CH-16.4)

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- PET/CT (CPT® 78815) for a solid lung nodule ≥ 8 mm on dedicated advanced chest imaging, as described in **Solitary Pulmonary Nodule - Imaging (CH-16.1)**. See **Non-Small Cell Lung Cancer – Suspected/Diagnosis (ONC-8.2)** in the Oncology Imaging Guidelines for lung mass ≥ 3.1 cm.
 - If there is a history of malignancy, refer to the appropriate Oncology restaging/recurrence guideline for indications for PET imaging.
 - Pleural nodule, See **Pleural-Based Nodules and Other Abnormalities (CH-17.1)**
 - Serial PET studies are not medically necessary
 - Not medically necessary for infiltrate, ground glass opacity, or hilar enlargement
 - Mediastinal lymphadenopathy - See **Mediastinal Lymphadenopathy (CH-2.3)** or Sarcoid concerns – See **Sarcoid (CH-15.1)**
- If a CT finding led to ordering a PET scan, and if that CT was >3 months ago, a repeat CT (CPT® 71250) or (CPT® 72160) is medically necessary prior to considering a PET scan.
 - A change in the status of the original finding may find that a PET scan is no longer medically necessary.

Evidence Discussion

PET/CT may be performed for evaluation of a solid lung nodule greater than or equal to 8mm on chest CT.^{1,2,6,7} PET/CT has good sensitivity and moderate specificity for detecting malignancy in individuals with a high risk of cancer and a nodule greater than or equal to 10mm.¹² Consensus opinion is that nodules <8 to 10mm are not reliably characterized by PET/CT.^{2,12} The false negative rate of PET/CT is higher for nodules <8 mm and for malignancies with low metabolic activity, such as adenocarcinoma in situ or well differentiated carcinoid tumor. PET/CT has a lower sensitivity and higher false negative rate for ground glass or part solid nodules.^{2,12} Infections and inflammatory disorders may cause false positive results.

Repeating a PET/CT is discouraged. If there is a high pretest probability of cancer, a negative PET/CT does not reliably rule out cancer and either continued surveillance for at least 2 years or tissue sampling is advised.^{2,13} If a solid nodule shows clear growth on serial CT's, a non-surgical biopsy or surgical resection is recommended unless there are specific contraindications.² A surgical diagnosis is recommended if the nodule is hypermetabolic on PET/CT.²

PET/CT may be indicated for the pre-treatment staging of individuals with confirmed or strongly suspected lung cancer, as detailed in the oncology guidelines.^{2,6,7}

Background and Supporting Information

- A **nodule** is any pulmonary or pleural lesion that is a discrete, spherical opacity 2-30mm 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 7-10mm, 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 percent of all 8mm 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.
 - There is decreased risk of primary cancer in individuals with 5 or more nodules, most of which likely resulted from prior granulomatous infection.
 - 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.
- **Ground glass** or subsolid opacities, which can harbor indolent adenocarcinoma with average doubling times of 3–5 years.
- **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.
- **Positive PET** is defined as a standardized uptake value (SUV) in the lung nodule greater than the baseline mediastinal blood pool. A positive PET can occur with infection or inflammation, including absence of lung cancer with localized infection, presence of lung cancer with associated (post-obstructive) infection and/or related inflammation.
- **False negative PET** can be seen in individuals with adenocarcinoma in situ (formally known as bronchoalveolar carcinoma), carcinoid tumors, a small size nodule, non-solid or ground glass opacity. High pre-test likelihood of malignancy with negative findings on PET only reduces the likelihood of malignancy to 14%; while in an individual with a low pre-test likelihood (20%) of malignancy, a negative PET reduces the likelihood of malignancy to 1%.

References (CH-16)

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1. MacMahon H, Naidich DP, Goo JM, et al. Guidelines for Management of Incidental Pulmonary Nodules Detected on CT Images: From the Fleischner Society 2017. *Radiology*. 2017;284(1):228-243. doi:10.1148/radiol.2017161659.
2. Gould MK, Donington J, Lynch WR, et al. Evaluation of individuals with pulmonary nodules: when is it lung cancer? Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013;143(5 Suppl):e93S-e120S. doi:10.1378/chest.12-2351.
3. Expert Panel on Thoracic Imaging; Martin MD, Henry TS, et al. ACR Appropriateness Criteria® Incidentally Detected Indeterminate Pulmonary Nodule. *J Am Coll Radiol*. 2023;20(11S):S455-S470. doi:10.1016/j.jacr.2023.08.024.
4. Truong MT, Ko JP, Rossi SE, et al. Update in the evaluation of the solitary pulmonary nodule. *Radiographics*. 2014;34(6):1658-1679. doi:10.1148/rg.346130092.
5. Lung CT Screening Reporting and Data System (Lung-RADS™), American College of Radiology, Quality & Safety. <https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Reporting-and-Data-Systems/Lung-RADS>.
6. National Comprehensive Cancer Network® (NCCN®) Guidelines® Version 1.2025 – October 14, 2024. Lung Cancer Screening. https://www.nccn.org/professionals/physician_gls/pdf/lung_screening.pdf. Referenced with permission from the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Lung Cancer Screening Version 1.2025. © 2024 National Comprehensive Cancer Network® (NCCN®). All rights reserved. NCCN Guidelines® and illustrations herein may not be reproduced in any form for any purpose without the express written permission of the NCCN. To view the most recent and complete version of the NCCN Guidelines®, go online to NCCN.org.
7. National Comprehensive Cancer Network® (NCCN®) Guidelines® Version 4.2025 – May 23, 2025. Non-Small Cell Lung Cancer. https://www.nccn.org/professionals/physician_gls/pdf/nscl.pdf. Referenced with permission from the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Non-Small Cell Lung Cancer Version 4.2025. © 2025 National Comprehensive Cancer Network® (NCCN®). All rights reserved. NCCN Guidelines® and illustrations herein may not be reproduced in any form for any purpose without the express written permission of the NCCN. To view the most recent and complete version of the NCCN Guidelines®, go online to NCCN.org.
8. Mets OM, Schaefer-Prokop CM, de Jong PA. Cyst-related primary lung malignancies: an important and relatively unknown imaging appearance of (early) lung cancer. *Eur Respir Rev*. 2018;27(150):180079. Published 2018 Dec 19. doi:10.1183/16000617.0079-2018.
9. Naeem MQ, Darira J, Ahmed MS, Hamid K, Ali M, Shazlee MK. Comparison of Maximum Intensity Projection and Volume Rendering in Detecting Pulmonary Nodules on Multidetector Computed Tomography. *Cureus*. 2021;13(3):e14025. Published 2021 Mar 21. doi:10.7759/cureus.14025.
10. Bankier AA, MacMahon H, Goo JM, Rubin GD, Schaefer-Prokop CM, Naidich DP. Recommendations for Measuring Pulmonary Nodules at CT: A Statement from the Fleischner Society. *Radiology*. 2017;285(2):584-600. doi:10.1148/radiol.2017162894.
11. Mankidy BJ, Mohammad G, Trinh K, et al. High risk lung nodule: A multidisciplinary approach to diagnosis and management. *Respir Med*. 2023;214:107277. doi:10.1016/j.rmed.2023.107277.
12. Callister ME, Baldwin DR, Akram AR, et al. British Thoracic Society guidelines for the investigation and management of pulmonary nodules [published correction appears in *Thorax*. 2015 Dec;70(12):1188. doi:10.1136/thoraxjnl-2015-207168corr1]. *Thorax*. 2015;70 Suppl 2:ii1-ii54. doi:10.1136/thoraxjnl-2015-207168.
13. Maiga AW, Deppen SA, Mercaldo SF, et al. Assessment of Fluorodeoxyglucose F18-Labeled Positron Emission Tomography for Diagnosis of High-Risk Lung Nodules. *JAMA Surg*. 2018;153(4):329-334. doi:10.1001/jamasurg.2017.4495.
14. Christensen J, Prosper AE, Wu CC, et al. ACR Lung-RADS v2022: Assessment Categories and Management Recommendations. *J Am Coll Radiol*. 2024;21(3):473-488. doi:10.1016/j.jacr.2023.09.009.

15. Li WJ, Chu ZG, Zhang Y, Li Q, Zheng YN, Lv FJ. Effect of Slab Thickness on the Detection of Pulmonary Nodules by Use of CT Maximum and Minimum Intensity Projection. *AJR Am J Roentgenol*. 2019;213(3):562-567. doi:10.2214/AJR.19.21325.
16. Fernandes S, Williams G, Williams E, et al. Solitary pulmonary nodule imaging approaches and the role of optical fibre-based technologies. *Eur Respir J*. 2021;57(3):2002537. Published 2021 Mar 25. doi:10.1183/13993003.02537-2020
17. Woodworth CF, Frota Lima LM, Bartholmai BJ, Koo CW. Imaging of Solid Pulmonary Nodules. *Clin Chest Med*. 2024;45(2):249-261. doi:10.1016/j.ccm.2023.08.013
18. Baum P, Schlamp K, Klotz LV, Eichhorn ME, Herth F, Winter H. Incidental Pulmonary Nodules: Differential Diagnosis and Clinical Management. *Dtsch Arztebl Int*. 2024;121(25):853-860. doi:10.3238/arztebl.m2024.0177
19. Mazzone PJ, Lam L. Evaluating the Patient With a Pulmonary Nodule: A Review. *JAMA*. 2022;327(3):264-273. doi:10.1001/jama.2021.24287
20. Munden RF, Black WC, Hartman TE, et al. Managing Incidental Findings on Thoracic CT: Lung Findings. A White Paper of the ACR Incidental Findings Committee. *J Am Coll Radiol*. 2021;18(9):1267-1279. doi:10.1016/j.jacr.2021.04.014
21. Chen H, Kim AW, Hsin M, et al. The 2023 American Association for Thoracic Surgery (AATS) Expert Consensus Document: Management of subsolid lung nodules. *J Thorac Cardiovasc Surg*. 2024;168(3):631-647.e11. doi:10.1016/j.jtcvs.2024.02.026
22. Sharma D, Khanduri R, Raghuvanshi S, et al. Clinical, radiological and histopathological profile of patients with endobronchial lesions on fiberoptic bronchoscopy. *Monaldi Arch Chest Dis*. 2022;93(3). doi:10.4081/monaldi.2022.2312
23. Kouvela M, Kakavas S, Karetsos C, & Balis E. Correlation of the imaging findings with bronchoscopic findings for the detection of endobronchial lesions: A systematic review and meta-analysis. *J Pulm Respir Med*. 2017;6:395. doi:10.4172/2161-105X.1000395
24. de Jong PA, Leiner T, Lammers JW, Gietema HA. Can low-dose unenhanced chest CT be used for follow-up of lung nodules?. *AJR Am J Roentgenol*. 2012;199(4):777-780. doi:10.2214/AJR.11.7577
25. Rampinelli C, Raimondi S, Padrenostro M, et al. Pulmonary nodules: Contrast-enhanced volumetric variation at different CT scan delays. *AJR Am J Roentgenol*. 2010;195(1):149-154. doi:10.2214/AJR.09.3212

Pleural-Based Nodules and Other Abnormalities (CH-17)

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Pleural-Based Nodules and Other Abnormalities (CH-17.1)

CH.PB.0017.1.A

v1.0.2026

- CT Chest with contrast (CPT[®] 71260) or CT Chest without contrast (CPT[®] 71250) (with contrast is preferred for initial evaluation) is medically necessary for pleural nodule(s).
 - Pleural nodule(s) seen on an imaging study other than a “dedicated” CT or MRI Chest.
 - Pleural nodule(s) identified incidentally on any of the following dedicated chest studies can replace CT Chest as the initial dedicated study.
 - CT Chest without and with contrast (CPT[®] 71270).
 - CTA Chest (CPT[®] 71275).
 - MRI Chest without contrast (CPT[®] 71550).
 - MRI Chest without and with contrast (CPT[®] 71552).
 - MRA Chest 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 **Solitary Pulmonary Nodule – Imaging (CH-16.1)**)
 - Following the Fleischner Society Guidelines for high-risk. (See **Incidental Pulmonary Nodules Detected on CT Images (CH-16.2)**)
- PET/CT (CPT[®] 78815) is medically necessary 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.
- For diagnosis or suspicion of pulmonary sequestration:
 - CT chest with contrast (CPT[®] 71260) OR CTA Chest (CPT[®] 71275)
 - 3D reconstruction as requested (CPT[®] 76377) or (CPT[®] 76376)

Evidence Discussion

- CT Chest is medically necessary for the evaluation of pleural nodules.¹⁻³ CT scan is widely available and allows for easy access to isotropic 3-D reformatting.³ A study looking at the utility of CT in investigation for malignancy showed a sensitivity of 68%, a specificity of 78%, a positive predictive value of 80% and a negative predictive value of 65% when CT findings were reported as malignant.³ CT also carries the risk of exposure to iodinated contrast and ionizing radiation.

- Follow up for previously detected pleural nodules follows guidelines addressed elsewhere in these guidelines (See **Solitary Pulmonary Nodule – Imaging (CH-16.1)** and **Incidental Pulmonary Nodules Detected on CT Images (CH-16.2)**).¹
 - Of note, a study looking at over 8,700 LDCT chest scans identified 943 noncalcified nodules attached to the costal pleura, of these 897 were < 10mm in size. There were 603 that were either lentiform, oval, semicircular or triangular in shape and had smooth margins. All of these nodules, that met these qualifications of shape, size and smooth margins, were benign. Follow-up with annual screening, rather than more immediate work-up, was recommended.²
- PET/CT may be considered when the identified pleural nodule/mass or thickening is ≥ 8mm and there is a likelihood of malignancy.¹ PET/CT may be useful in differentiating between benign and malignant disease; however, studies have shown a broad range of sensitivities (88-100%) and specificities (35-100%).³ PET/CT may be complicated by false positives such as infections and prior pleurodesis with talc, or false negatives such as low grade/low metabolic activity epithelioid mesothelioma.³

Background and Supporting Information

- Pleural nodule/mass or thickening without suggestion of malignancy would undergo surveillance or biopsy.
- A study looking at over 8,700 LDCT chest scans identified 943 noncalcified nodules attached to the costal pleura, of these 897 were <10mm in size. There were 603 that were either lentiform, oval, semicircular or triangular in shape and had smooth margins. All of these nodules, that met these qualifications of shape, size and smooth margins, were benign. Follow-up with annual screening, rather than more immediate work-up, was recommended.

Reference (CH-17)

v1.0.2026

1. Rivera MP, Mehta AC, Wahidi MM. 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;143(5 Suppl):e142S-e165S. doi:10.1378/chest.12-2353.
2. Zhu Y, Yip R, You N, Henschke CI, Yankelevitz DF. Management of Nodules Attached to the Costal Pleura at Low-Dose CT Screening for Lung Cancer. *Radiology*. 2020;297(3):710-718. doi:10.1148/radiol.2020202388.
3. Hallifax RJ, Talwar A, Wrightson JM, Edey A, Gleeson FV. State-of-the-art: Radiological investigation of pleural disease. *Respir Med*. 2017;124:88-99. doi:10.1016/j.rmed.2017.02.013.
4. Lee GM, Walker CM. Pleural Thickening: Detection, Characterization, and Differential Diagnosis. *Semin Roentgenol*. 2023;58(4):399-410. doi:10.1053/j.ro.2023.06.001
5. Gabelloni M, Faggioni L, Accogli S, Aringhieri G, Neri E. Pulmonary sequestration: What the radiologist should know. *Clin Imaging*. 2021;73:61-72. doi:10.1016/j.clinimag.2020.11.040
6. Liu X, Wu R, Zhu S, Gu L, Tang Z. Imaging and pathological characteristics, treatment, and prognosis of pulmonary sequestration-A retrospective study of 13 cases. *Clin Respir J*. 2023;17(9):865-873. doi:10.1111/crj.13672
7. Petty L, Joseph A, Sanchez J. Case report: Pulmonary sequestration in an adult. *Radiol Case Rep*. 2017;13(1):21-23. Published 2017 Nov 21. doi:10.1016/j.radcr.2017.09.029
8. Alsumrain M, Ryu JH. Pulmonary sequestration in adults: a retrospective review of resected and unresected cases. *BMC Pulm Med*. 2018;18(1):97. Published 2018 Jun 5. doi:10.1186/s12890-018-0663-z

Pleural Effusion (CH-18)

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Pleural Effusion (CH-18.1)

CH.EF.0018.1.A

v1.0.2026

- CT Chest with contrast (CPT[®] 71260) is medically necessary after:
- Chest x-ray, (upright posterior/anterior/lateral best), (lateral decubitus films can improve sensitivity); **and**
one of the following:
 - Thoracentesis, (if possible) 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)
 - Concern for loculated effusion, empyema, paramediastinal location, subpleural lung abscess or cavitation
 - Check position of chest tube(s) or drainage catheters
 - Surgical planning
- Chest ultrasound (CPT[®] 76604) can be used as an alternative or adjunct to chest x-ray to evaluate for the presence of fluid within the pleural spaces and guide thoracentesis.

Evidence Discussion

The most common initial diagnostic test suggesting a pleural effusion is often chest radiography (CR). CR remains the most accessible form of chest imaging and will often be the initial study for suspected pleural disease.^{1,2} Lateral decubitus CR has higher sensitivity and specificity for pleural effusion than other positions.³ However, complicated effusions are often loculated and may not layer dependently. Lower lobe consolidation may mask the presence of an effusion. The American Association for Thoracic Surgery (AATS) states that CR, although useful as a first step, should be combined with additional imaging if pleural space infection is suspected.^{2,9} The American College of Radiology (ACR) states that consensus recommendations endorse CR as the initial imaging modality for suspected parapneumonic or malignant effusion, but there are limited empiric data to support this.

Ultrasound (US) is at least as effective as lateral decubitus views for the detection of pleural fluid and provides a better estimation of fluid volume.¹⁻³ When standard CR cannot rule out a pleural effusion, US has largely replaced decubitus views due to its speed, portability and greater sensitivity. Identification of a pleural effusion for possible US-guided thoracentesis is the primary reason for chest US. The AATS guidelines state that CR and US are class 1 recommendations (should be done) for suspected pleural space infection.² US is more sensitive than CR for detecting pleural effusion.^{6,10}

Although diagnostic imaging plays an important role in the evaluation of pleural effusions, thoracentesis with pleural fluid analysis remains the necessary first invasive step. Pleural fluid analysis is considered mandatory unless the clinical presentation suggests a high pretest probability of a transudative effusion.¹ Initial evaluation should include an ultrasound (US)-guided thoracentesis to categorize the effusion as a transudate or exudate and obtain specimens for microbiology and cytology.^{4,5} If a parapneumonic effusion is suspected, diagnostic aspiration must be performed to identify individuals with a complicated effusion that requires drainage.^{2,4}

CT is not used routinely as the initial imaging study for pleural effusion unless there is suspicion for loculated fluid in an interlobar fissure or paramediastinal location, or CR demonstrates parenchymal lesions suggestive of cancer, septic emboli or cavitation. CT can better distinguish between a loculated empyema and subpleural lung abscess. CT with IV contrast optimizes imaging of the pleura. CT chest with contrast is a class 2a recommendation (reasonable) for suspected pleural space infection in the AATS guidelines.² If the etiology of an exudative effusion cannot be identified, or if it is not safe to perform a thoracentesis, a CT chest with contrast is medically necessary.^{4,5} The American College of Radiology (ACR) states that CR or CT chest with IV contrast is medically necessary as initial imaging for people with recent pneumonia and suspected parapneumonic effusion or for people with dyspnea, cough or chest pain with a suspected malignant pleural effusion. Thoracentesis and chest CT cannot rule out malignancy or tuberculosis. Pleural biopsy is indicated for a recurrent undiagnosed exudative effusion.^{1,4,5} When a diagnosis cannot be made, monitoring with interval CT scans for up to 2 years is medically necessary.⁵ CT is used in the diagnosis and management of late-stage empyema and malignant pleural effusion and can be used to check the position of drains and plan for surgical intervention.¹ CT scans have high specificity but low sensitivity in distinguishing benign from malignant pleural effusion.⁶

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.
- PA chest x-ray can show a pleural effusion with approximately 200 ml of pleural fluid while a lateral view can reduce this to 50 ml. Ultrasound is even more sensitive with as little as 3-5 ml of fluid being detected. *Thoracentesis can only be safely performed with adequate fluid present. If only a trace effusion or inadequate amount of fluid is seen, a thoracentesis may not be possible.

References (CH-18)

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1. Sundaralingam A, Bedawi EO, Rahman NM. Diagnostics in Pleural Disease. *Diagnostics (Basel)*. 2020;10(12):1046. Published 2020 Dec 4. doi:10.3390/diagnostics10121046.
2. Shen KR, Bribresco A, Crabtree T, et al. The American Association for Thoracic Surgery consensus guidelines for the management of empyema. *J Thorac Cardiovasc Surg*. 2017;153(6):e129-e146. doi:10.1016/j.jtcvs.2017.01.030.
3. Zaki HA, Albaroudi B, Shaban EE, et al. Advancement in pleura effusion diagnosis: a systematic review and meta-analysis of point-of-care ultrasound versus radiographic thoracic imaging. *Ultrasound J*. 2024;16(1):3. Published 2024 Jan 23. doi:10.1186/s13089-023-00356-z.
4. Beaudoin S, Gonzalez AV. Evaluation of the patient with pleural effusion. *CMAJ*. 2018;190(10):E291-E295. doi:10.1503/cmaj.170420.
5. Roberts ME, Rahman NM, Maskell NA, et al. British Thoracic Society Guideline for pleural disease. *Thorax*. 2023;78(11):1143-1156. doi:10.1136/thorax-2023-220304.
6. Orlandi R, Cara A, Cassina EM, et al. Malignant Pleural Effusion: Diagnosis and Treatment-Up-to-Date Perspective. *Curr Oncol*. 2024;31(11):6867-6878. Published 2024 Nov 2. doi:10.3390/curroncol31110507
7. Yamada A, Taiji R, Nishimoto Y, et al. Pictorial Review of Pleural Disease: Multimodality Imaging and Differential Diagnosis. *Radiographics*. 2024;44(4):e230079. doi:10.1148/rg.230079
8. Tsakok M, Hallifax R. Updates in Pleural Imaging. *Clin Chest Med*. 2021;42(4):577-590. doi:10.1016/j.ccm.2021.07.001
9. Shen-Wagner J, Gamble C, MacGilvray P. Pleural Effusion: Diagnostic Approach in Adults. *Am Fam Physician*. 2023;108(5):464-475.
10. Shao RJ, Du MJ, Xie JT. Use of lung ultrasound for the diagnosis and treatment of pleural effusion. *Eur Rev Med Pharmacol Sci*. 2022;26(23):8771-8776. doi:10.26355/eurev_202212_30548

Pneumothorax/ Hemothorax (CH-19)

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Pneumothorax/Hemothorax (CH-19.1)

CH.PT.0019.1.A

v1.0.2026

Chest x-ray and CT Chest are the first line tests for detecting pneumothorax/hemothorax and ruling out other lung diseases.

- Chest x-ray is medically necessary 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
 - preoperative study for treatment of pneumothorax
 - pneumothorax associated with hemothorax
 - suspected complications from hemothorax (e.g., empyema)
 - suspected Alpha-1-Antitrypsin Deficiency (even without pneumothorax)
 - suspected cystic lung disease, including lymphangioleiomyomatosis (LAM), tuberous sclerosis (TS), or Birt-Hogg-Dube (BHD) syndrome
 - to determine the etiology of persistent pneumothorax/air leak, such as chest tube malposition, bronchopleural fistula, loculated pneumothorax, lung parenchymal disease
 - suspected catamenial pneumothorax/thoracic endometriosis
- MRI Chest without and with contrast (CPT[®] 71552) or MRI Chest without contrast (CPT[®] 71550) for:
 - detecting diaphragmatic endometriosis
 - pre-surgical planning for thoracic endometriosis

Evidence Discussion

The majority of pneumothorax cases can be confirmed by upright PA chest radiography (CR), which remains the standard initial exam.¹⁶ While US has a high sensitivity/specificity for pneumothorax, it is operator-dependent and is not medically necessary as a primary imaging modality.¹⁹⁻²²

While CT is more sensitive than CR in detecting pneumothorax, it is generally not medically necessary for diagnosis and should be avoided due to excess radiation.¹⁶ CT may be medically necessary for diagnosing a very small pneumothorax or differentiating between a pneumothorax and a giant bulla in bullous emphysema. Although CT is the best method to measure the size of a pneumothorax, current evidence does not support basing treatment decisions solely on size.¹⁴

The 2001 ACCP guidelines advise against routine CT use for a first-time primary spontaneous pneumothorax (PSP). However, CT may be medically necessary

to evaluate suspected pulmonary disorders not apparent on CR. For secondary spontaneous pneumothorax (SSP), CT is acceptable for managing recurrent pneumothorax, persistent air leak, and surgical planning.

In contrast, the 2023 British Thoracic Society recommends CT chest for individuals with symptoms and high-risk characteristics. These include hemodynamic compromise, significant hypoxia, bilateral pneumothorax, underlying lung disease, hemopneumothorax, or age over 49 with a significant smoking history. This recommendation applies if the pneumothorax size on CR is insufficient for safe needle aspiration or chest tube intervention. The European Respiratory Society suggests that CT may be useful in complicated cases, when chest tube misalignment is suspected, when underlying lung disease is suspected, and in individuals requiring surgery.¹⁶

High-resolution CT (HRCT) has better sensitivity than routine CT in the pre-operative detection of blebs and bullae.¹⁴ However, it is unclear whether HRCT can predict the risk of recurrence or identify which individuals may benefit from surgical intervention. It may help to identify those at lower risk: the positive predictive value of CT bleb scores for ipsilateral recurrence is relatively low at 68%, while the negative predictive value is high at 94%.¹⁵

Some experts advise considering a CT scan after a first time PSP if there are factors such as a family history of pneumothorax, presence of blebs, cysts, or bullae; female sex; or a family or personal history and/or physical examination findings suggestive of a pneumothorax-associated syndrome.¹⁸

Although they have low specificity, the most sensitive tests for detecting pneumothorax and hemothorax are CR and CT. For detecting diaphragmatic endometriosis, Magnetic Resonance Imaging (MRI) of the chest is preferable.⁵

Pneumomediastinum; Subcutaneous Emphysema (CH-19.2)

CH.PT.0019.2.A

v1.0.2026

- Chest x-ray is medically necessary initially.
 - CT Chest with contrast (CPT[®] 71260) or without contrast (CPT[®] 71250) if:
 - recent vomiting and/or suspected esophageal perforation
 - associated pneumopericardium
 - associated pneumothorax
 - preoperative study for treatment

Evidence Discussion

The diagnosis of Pneumomediastinum (PM) is usually established by a clinical exam and CR. The CR should include a lateral view.⁸ CR is the most common diagnostic imaging study.⁹⁻¹¹ The reported sensitivity of CR ranges from 60-90%.^{9,12} CT is more sensitive than CR, especially in cases of small amounts of air in the mediastinum.⁸

There is no evidence defining when CT should be used to evaluate pneumomediastinum (PM). CT should be done if the suspicion for PM remains high despite a normal CR or if there is concern for secondary PM due to a specific pathologic event.⁹

CT can be beneficial in detecting injury to the tracheobronchial system, pneumothorax, pneumopericardium or esophageal perforation.¹² Despite the usually benign and self-limiting course of spontaneous PM, additional imaging is often undertaken to rule out esophageal perforation or other underlying disorder. A retrospective review of adolescents and young adults with spontaneous PM demonstrated that no clear criteria were used for obtaining a CT and that the CT's did not impact clinical decisions.¹³ The authors concluded that advanced imaging is over-utilized in individuals with suspected spontaneous PM without clinical evidence of necessity.

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, pneumomediastinum, or hemothorax who are asymptomatic or have stable symptoms. With the exception of the indications above, advanced imaging of the chest is not medically necessary in the diagnosis or management of pneumothorax, or pneumomediastinum. Inspiratory/expiratory chest x-rays are helpful in defining whether a pneumothorax is present.

References (CH-19)

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1. Sandhaus RA, Turino G, Brantly ML, et al. The Diagnosis and Management of Alpha-1 Antitrypsin Deficiency in the Adult. *Chronic Obst Pulm Dis*. 2016;3(3):668-682. Published 2016 Jun 6. doi:10.15326/jcopdf.3.3.2015.0182.
2. Daccord C, Good JM, Morren MA, Bonny O, Hohl D, Lazor R. Birt-Hogg-Dubé syndrome. *Eur Respir Rev*. 2020;29(157):200042. Published 2020 Sep 17. doi:10.1183/16000617.0042-2020.
3. Raoof S, Bondalapati P, Vydyula R, et al. Cystic Lung Diseases: Algorithmic Approach. *Chest*. 2016;150(4):945-965. doi:10.1016/j.chest.2016.04.026.
4. Rousset P, Rousset-Jablonski C, Alifano M, Mansuet-Lupo A, Buy JN, Revel MP. Thoracic endometriosis syndrome: CT and MRI features. *Clin Radiol*. 2014;69(3):323-330. doi:10.1016/j.crad.2013.10.014.
5. Nezhat C, Lindheim SR, Backhus L, et al. Thoracic Endometriosis Syndrome: A Review of Diagnosis and Management. *JSLs*. 2019;23(3):e2019.00029. doi:10.4293/JSLs.2019.00029.
6. McKee DC, Mansour T, Wasson MN. Thoracic and diaphragmatic endometriosis: an overview of diagnosis and surgical treatment. *Curr Opin Obstet Gynecol*. 2022;34(4):204-209. doi:10.1097/GCO.0000000000000792.
7. Chaturvedi A, Lee S, Klionsky N, Chaturvedi A. Demystifying the persistent pneumothorax: role of imaging. *Insights Imaging*. 2016;7(3):411-429. doi:10.1007/s13244-016-0486-5.
8. Dirweesh A, Alvarez C, Khan M, Christmas D. Spontaneous pneumomediastinum in a healthy young female: A case report and literature review. *Respir Med Case Rep*. 2017;20:129-132. Published 2017 Feb 6. doi:10.1016/j.rmcr.2017.01.014.
9. Magouliotis DE, Sgantzou I, Salemis NS, et al. Pneumomediastinum: Experience with 87 Patients. *Acta Med Acad*. 2023;52(2):88-94. doi:10.5644/ama2006-124.408.
10. Morgan CT, Maloney JD, Decamp MM, McCarthy DP. A narrative review of primary spontaneous pneumomediastinum: a poorly understood and resource-intensive problem. *J Thorac Dis*. 2021;13(6):3721-3730. doi:10.21037/jtd-21-193.
11. Alemu BN, Yeheyis ET, Tiruneh AG. Spontaneous primary pneumomediastinum: is it always benign?. *J Med Case Rep*. 2021;15(1):157. Published 2021 Mar 25. doi:10.1186/s13256-021-02701-z.
12. Susai CJ, Banks KC, Alcasid NJ, Velotta JB. A clinical review of spontaneous pneumomediastinum. *Mediastinum*. 2023;8:4. Published 2023 Oct 27. doi:10.21037/med-23-25.
13. Wald L, Yergin C, Petroze R, Larson S, Islam S. The unnecessary workups and admissions of adolescents and young adults with spontaneous pneumomediastinum. *Sci Rep*. 2024;14(1):4501. Published 2024 Feb 24. doi:10.1038/s41598-024-55134-1.
14. Mendogni P, Vannucci J, Ghisalberti M, et al. Epidemiology and management of primary spontaneous pneumothorax: a systematic review. *Interact Cardiovasc Thorac Surg*. 2020;30(3):337-345. doi:10.1093/icvts/izv290.
15. Barton EC, Maskell NA, Walker SP. Expert Review on Spontaneous Pneumothorax: Advances, Controversies, and New Directions. *Semin Respir Crit Care Med*. 2023;44(4):426-436. doi:10.1055/s-0043-1769615.
16. Tschopp JM, Bintlcliffe O, Astoul P, et al. ERS task force statement: diagnosis and treatment of primary spontaneous pneumothorax. *Eur Respir J*. 2015;46(2):321-335. doi:10.1183/09031936.00219214.
17. Roberts ME, Rahman NM, Maskell NA, et al. British Thoracic Society Guideline for pleural disease. *Thorax*. 2023;78(Suppl 3):s1-s42. doi:10.1136/thorax-2022-219784.
18. Boone PM, Scott RM, Marciniak SJ, Henske EP, Raby BA. The Genetics of Pneumothorax. *Am J Respir Crit Care Med*. 2019;199(11):1344-1357. doi:10.1164/rccm.201807-1212CI.
19. Sheng B, Tao L, Zhong C, Gao L. Comparing the Diagnostic Performance of Lung Ultrasonography and Chest Radiography for Detecting Pneumothorax in Patients with Trauma: A Meta-Analysis. *Respiration*. 2025;104(3):161-175. doi:10.1159/000540777
20. Ron E, Alattar Z, Hoebee S, Kang P, vanSonnenberg E. Current Trends in the Use of Ultrasound Over Chest X-Ray to Identify Pneumothoraces in ICU, Trauma, and ARDS Patients. *J Intensive Care Med*. 2022;37(1):5-11. doi:10.1177/0885066620987813
21. Tran J, Haussner W, Shah K. Traumatic Pneumothorax: A Review of Current Diagnostic Practices And Evolving Management. *J Emerg Med*. 2021;61(5):517-528. doi:10.1016/j.jemermed.2021.07.006

22. Choi J, Villarreal J, Andersen W, et al. Scoping review of traumatic hemothorax: Evidence and knowledge gaps, from diagnosis to chest tube removal. *Surgery*. 2021;170(4):1260-1267. doi:10.1016/j.surg.2021.03.030

Mediastinal Mass (CH-20)

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Mediastinal Mass (CH-20.1)

CH.MM.0020.1.A

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- 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) is medically necessary to evaluate mediastinal abnormalities (e.g., mediastinal cyst, including bronchogenic, thymic, pericardial, or esophageal) seen on chest x-ray or other non-dedicated chest imaging.
- MRI Chest without and with contrast (CPT[®] 71552) or MRI Chest without contrast (CPT[®] 71550) is medically necessary for indeterminate mediastinal mass on CT Chest.
 - Surveillance imaging is medically necessary no more frequently than 3-month intervals over 2 or more years when the lesion(s) remain indeterminate on MRI and a biopsy has not been performed.
- FDG PET/CT offers limited additional value beyond that of conventional CT in the initial assessment of mediastinal mass(es), with the exception of primary mediastinal lymphoma. See **Non-Hodgkin Lymphomas (ONC-27)** or **Hodgkin Lymphoma (ONC-28)** in the Oncology Imaging Guidelines. A positive FDG PET/CT has little value for discrimination between benign and malignant lesions. A negative FDG PET/CT does not prevent serial CT/MRIs, due to appreciable false negative rate.
 - MRI Chest without and with contrast (CPT[®] 71552) or MRI Chest without contrast (CPT[®] 71550) is medically necessary for indeterminate mediastinal mass on FDG PET/CT.
- 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) is medically necessary for subsequent evaluations if:
 - new signs or symptoms, or
 - preoperative assessment
- For Adenopathy; See **Lymphadenopathy (CH-2)**.
- For Goiter; See **Thyroid Nodule (NECK-8.1)** in the Neck Imaging Guidelines.
- For Myasthenia Gravis; See **Neuromuscular Junction Disorders (PN-6.1)** in the Peripheral Nerve Disorders Imaging Guidelines.
- For fibrosing mediastinitis: See **Fungal Infections (Suspected or Known) (CH-14.2)**

Evidence Discussion

Mediastinal nodules or masses may present as incidental findings on chest radiographs and cross-sectional imaging. Alternatively, they may be found during the evaluation of symptoms and signs that include chest pain, cough, dyspnea, dysphagia, cardiac tamponade, diaphragmatic paralysis, central venous thrombosis, superior vena cava

syndrome, B-symptoms (in lymphoma), myasthenia gravis, and other paraneoplastic syndromes. The incidence rate is low with a reported prevalence of 0.73-4%. The most frequent lesions encountered in the mediastinum are thymoma, neurogenic tumours and benign cysts.²

CT is superior to chest radiography for detection of invasion of the mass across tissue planes, secondary to its higher contrast resolution. Anterior mediastinal tumors account for 50% of all mediastinal masses. CT has the ability to show the precise location, morphology, and pattern of contrast enhancement of an anterior mediastinal mass as well as its relationship to other mediastinal components or borders.^{2,6}

MRI remains superior to CT for detection of invasion of the mass across tissue planes, including the chest wall and diaphragm, and involvement of neurovascular structures secondary to its higher soft-tissue contrast. MRI allows further tissue characterization of mediastinal masses beyond that of CT and FDG-PET/CT. Chemical-shift MRI has been shown to be useful in distinguishing normal thymus and thymic hyperplasia from thymic neoplasms and lymphoma. It can also prove the cystic nature of an indeterminate, non-water attenuation thymic mass on CT, preventing unnecessary biopsy and thymectomy. The frequency of surveillance imaging for indeterminate lesions seen on MRI is usually 3-12 month intervals over 2 years or more, depending upon level of clinical concern.^{2,4,6} The diagnostic accuracy of chest MRI for the detection of mediastinal mass is 71-91%.⁴

(FDG)-PET/CT offers limited additional value beyond that of conventional CT in the initial assessment of mediastinal masses, with the exception of its use for primary mediastinal lymphoma staging and surveillance and detection of metastatic lymphadenopathy. A positive FDG-PET/CT has little value for discrimination between benign and malignant lesions.^{2,3,5,6}

It is reasonable to perform a chest radiograph as an initial imaging step. Chest radiography can help localize a mass to a specific mediastinal compartment and thereby narrow the differential diagnosis. Chest radiography offers limited assistance regarding tissue characterization of mediastinal masses, with the exception of its occasional demonstration of calcium within a lesion.²

There is little relevant literature to support the use of ultrasound (US) in the initial evaluation of a clinically suspected mediastinal mass.²

Fibrosing mediastinitis (FM) is a rare benign but potentially life threatening process characterized by progressive proliferation of dense infiltrative fibrous tissue in the mediastinum and/or hila. Granulomatous FM is the more common subtype in the US and is typically associated with prior infection with histoplasmosis. Nongranulomatous FM is less common and is usually associated with an autoimmune disorder, drug exposure, or prior radiation. The most common symptoms are cough, dyspnea, hemoptysis, and pleuritic chest pain. Individuals may develop SVC syndrome or post-obstructive pneumonia. Widening of the mediastinum and mediastinal/hilar

lymphadenopathy are the most common abnormal findings on chest x-ray. CT chest with contrast is the modality of choice for suspected FM. MRI is equivalent to CT for evaluating extent of disease, but CT is superior for evaluation of airways and calcification. PET CT is nonspecific and not routinely used. Nonsurgical and surgical procedures for individuals with clinical symptoms are related to compression or obstruction of mediastinal structures. CTA chest may be used for procedural planning or to evaluate the patency of vascular stents. There are no consensus guidelines for follow up imaging. No routine imaging is medically necessary for the granulomatous subtype unless there are progressive symptoms or clinical decompensation. Regular surveillance with CT is recommended for the nongranulomatous subtype to rule out malignancy which may not have been sampled in a biopsy.⁷

References (CH-20)

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1. Komanapalli C, Schipper P, Sukumar M. Pericardial Cyst. October 2022. doi:10.25373/ctsnet.21280404.
2. Expert Panel on Thoracic Imaging; Ackman JB, Chung JH, et al. ACR Appropriateness Criteria® Imaging of Mediastinal Masses. *J Am Coll Radiol*. 2021;18(5S):S37-S51. doi:10.1016/j.jacr.2021.01.007.
3. Proli C, De Sousa P, Jordan S, et al. A diagnostic cohort study on the accuracy of 18-fluorodeoxyglucose (¹⁸FDG) positron emission tomography (PET)-CT for evaluation of malignancy in anterior mediastinal lesions: the DECiMaL study. *BMJ Open*. 2018;8(2):e019471. doi:10.1136/bmjopen-2017-019471.
4. Kim JH, Choe J, Kim HK, Lee HY. MRI-Based Stepwise Approach to Anterior Mediastinal Cystic Lesions for Diagnosis and Further Management. *Korean J Radiol*. 2023;24(1):62-78. doi:10.3348/kjr.2022.0606
5. Reddy R. Comparative Role of MDCT and FDG-PET/CT in the Diagnostic Evaluation of Mediastinal Mass Lesions: An Institutional Experience. *World J Nucl Med*. 2022;21(3):200-209. Published 2022 Aug 25. doi:10.1055/s-0042-1751032
6. Jain V, Ahuja J, Strange CD, et al. Imaging of mediastinal masses. *Radiol Clin N Am*. 2025. In Press. doi:10.1016/j.rcl.2024.12.006
7. Garrana SH, Buckley JR, et al. Multimodality Imaging of focal and diffuse fibrosing mediastinitis. *Radiographics* 2019; 39(3): 651-667.

Chest Trauma (CH-21)

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Chest Trauma (CH-21.1)

CH.CT.0021.1.A

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- Chest x-ray is medically necessary initially.
 - CT Chest without contrast (CPT[®] 71250) or with contrast (CPT[®] 71260) is medically necessary for the following situations:
 - Rib or sternal Fracture when clinical findings or other imaging identifies associated complications including pneumothorax, hemothorax, pulmonary contusion, atelectasis, flail chest, cardiovascular injury and/or injuries to solid or hollow abdominal organs.
 - Rib or sternal fracture when malignancy is suspected as the etiology for uncomplicated, single fractures, multiple fractures, non-acute fractures, or occult rib fractures that are identified on x-ray.
 - Routine follow-up advanced imaging of rib or sternal fractures is not medically necessary.
- CT Chest without contrast (CPT[®] 71250) or Tc-99m bone scan whole body (CPT[®] 78306) is medically necessary for suspected pathological rib fractures, with or without a history of trauma
- For clavicle fractures and sterno-clavicular (SC) dislocation, see **Joint Instability and Dysfunction (MS-30.0)**.
- Advanced imaging of the abdomen or pelvis is not medically necessary for chest trauma when there is no physical examination or laboratory evidence of abdominal and/or pelvic injury.

Evidence Discussion

- Chest x-ray, in combination with physical exam, is the appropriate initial diagnostic modality in those with suspected rib or sternal fracture after chest trauma. Although chest x-ray has low sensitivity (approximately 50%) for detection of rib fracture,¹ it has the benefit of being widely and readily available and able to detect complications that may require additional imaging such as pneumo- or hemothorax and pulmonary contusions.^{1,2} In addition, failure to detect rib fractures in uncomplicated cases does not significantly alter the individual management or outcomes. A study by Bansidhar et al. showed no difference in treatment in individual with minor chest trauma who did and did not have rib fractures diagnosed either clinically or radiographically.¹ Therefore, in uncomplicated cases, additional advanced imaging is not medically necessary. Rodriguez et al. demonstrated that yield for CT of thoracic injury with major clinical significance after a normal chest x-ray is 1.5% and would only detect one major injury for every 67 studies.³

- In cases where complications are identified clinically or by other imaging, additional imaging with CT chest is medically necessary. CT does have higher sensitivity for detection of rib fractures¹ and in the detection and extent of pulmonary injuries.² It also may be useful in differentiating blunt cardiac injury from acute myocardial infarction. However, CT does carry with it the risk of contrast related renal injury and allergic reactions.³ It also exposes the individual to a greater amount of ionizing radiation than a chest x-ray and subsequent increased risk of induced cancers.³ It is estimated that undergoing chest CT will result in one radiation induced cancer per every 720 40-year-old females and 1,538 40-year-old males.³
- If a pathological rib fracture is suspected, imaging with either a CT chest or Tc-99m bone scan is medically necessary. CT may be helpful in differentiating primary tumor from metastasis and may aid in detection of the primary malignancy.¹ Tc-99m bone scan has low specificity but high sensitivity (>95%) for detection of pathologic rib fractures.¹
- Medial clavicular fractures are rare (<5% of cases) and may necessitate additional imaging with CT or MRI for evaluation.⁴ Midshaft and distal clavicular fractures are usually sufficiently evaluated by x-ray.⁴
- Chest x-ray has poor sensitivity for identification of sternoclavicular dislocations. Given the risk for complications such as pneumothorax in posterior displacement, advanced imaging may be medically necessary. CT is advantageous as it has superior image resolution. It also allows for 3D reconstruction to determine exact position of the sternoclavicular joint. MRI can also be utilized but it has poorer resolution than CT. However, it may be advantageous for evaluation of soft tissue conditions or ligamentous injury.⁵
- For isolated chest injury without signs or symptoms of abdominal or pelvic injury, advanced imaging of the abdomen or pelvis is not medically necessary. If abdominal or pelvic injury is suspected, imaging is as dictated elsewhere in these guidelines.

References (CH-21)

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1. Expert Panel on Thoracic Imaging: Henry TS, Donnelly EF, et al. ACR Appropriateness Criteria® Rib Fractures. *J Am Coll Radiol*. 2019;16(5S):S227-S234. doi:10.1016/j.jacr.2019.02.019.
2. Lewis BT, Herr KD, Hamlin SA, et al. Imaging Manifestations of Chest Trauma. *Radiographics*. 2021;41(5):1321-1334. doi:10.1148/rg.2021210042.
3. Rodriguez RM, Hendey GW, Mower WR. Selective chest imaging for blunt trauma patients: The national emergency X-ray utilization studies (NEXUS-chest algorithm). *Am J Emerg Med*. 2017;35(1):164-170. doi:10.1016/j.ajem.2016.10.066.
4. Flores DV, Goes PK, Gómez CM, Umpire DF, Pathria MN. Imaging of the Acromioclavicular Joint: Anatomy, Function, Pathologic Features, and Treatment. *Radiographics*. 2020;40(5):1355-1382. doi:10.1148/rg.2020200039.
5. Morell DJ, Thyagarajan DS. Sternoclavicular joint dislocation and its management: A review of the literature. *World J Orthop*. 2016;7(4):244-250. Published 2016 Apr 18. doi:10.5312/wjo.v7.i4.244.
6. Doyle JE, Diaz-Gutierrez I. Traumatic sternal fractures: a narrative review. *Mediastinum*. 2021;5:34. Published 2021 Dec 25. doi:10.21037/med-21-27
7. Armstrong BA, Lorch SM, Diaz JJ. Sternal fracture management. *Curr Probl Surg*. 2025;64:101725. doi:10.1016/j.cpsurg.2025.101725

Chest Wall Mass (CH-22)

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Chest Wall Mass (CH-22.1)

CH.CM.0022.1.A

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- Chest x-ray is useful in the workup of a soft-tissue mass and is almost always medically necessary as the initial imaging study.
 - Chest ultrasound (CPT[®] 76604) is medically necessary 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.
 - Following a non-diagnostic chest x-ray that does not show an obvious lipoma(s) or clearly benign entity (see **Tissue Growths and Masses (MS-10)** in the Musculoskeletal Imaging Guidelines), ONE of the following is medically necessary:
 - MRI Chest without and with contrast (CPT[®] 71552) or
 - MRI Chest without contrast (CPT[®] 71550) or when MRI is contraindicated,
 - CT Chest with contrast (CPT[®] 71260) or
 - CT Chest without contrast (CPT[®] 71250)

Evidence Discussion

Radiography is medically necessary as the initial imaging study for both superficial and non-superficial soft tissue masses. Radiography can help identify calcifications, bone involvement, intrinsic fat, and unsuspected skeletal abnormality or deformity. In general, radiographic findings related to a soft tissue mass can provide helpful insight in determining the next most appropriate imaging modality for further characterization.¹⁻⁵

Non-contrast enhanced ultrasound is also an excellent triage tool for evaluating superficial soft tissue masses like superficial lipomas.^{1,3-5} However, ultrasound is not sufficient to assess for malignancy. When features detected on ultrasound are not clearly benign or when findings are concerning, further advanced imaging is medically necessary.¹

MRI without and with IV contrast is medically necessary as the next imaging study for a soft tissue mass following non-diagnostic radiographs.¹⁻⁴

MRI helps to define intrinsic tumor characterization, vascular structures, neurovascular involvement, hemorrhage, edema, and tumor necrosis. MRI without IV contrast may be beneficial compared with CT, but the use of MR contrast improves the differentiation of benign from malignant soft tissue masses.¹⁻⁴ At least 20% to 25% of soft tissue masses can demonstrate features that allow for confident diagnosis based on MRI alone, many of which are benign and thus would not warrant biopsy.^{1,3,4} MRI has a sensitivity of 96%, a specificity of 72%, a positive predictive value of 77%, a negative predictive value of 83%, and a diagnostic accuracy of 88%.⁶

When MRI is contraindicated, CT with IV contrast is medically necessary following non-diagnostic radiograph.

CT with IV contrast is useful in distinguishing vascularized from potentially necrotic regions of a tumor or calcification.¹⁻⁴

Background and Supporting Information

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

References (CH-22)

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1. Expert Panel on Musculoskeletal Imaging; Garner HW, Wessell DE, et al. ACR Appropriateness Criteria® Soft Tissue Masses: 2022 Update. *J Am Coll Radiol*. 2023;20(5S):S234-S245. doi:10.1016/j.jacr.2023.02.009
2. Expert Panel on Musculoskeletal Imaging; Ahlawat S, Lenchik L, Baker JC, et al. ACR Appropriateness Criteria® Suspected Primary Bone Tumors. 2024.
3. Haseli S, Mansoori B, Shafiei M, et al. A Review of Posteromedial Lesions of the Chest Wall: What Should a Chest Radiologist Know?. *Diagnostics (Basel)*. 2022;12(2):301. Published 2022 Jan 25. doi:10.3390/diagnostics12020301
4. Mansour J, Raptis D, Bhalla S, et al. Diagnostic and Imaging Approaches to Chest Wall Lesions. *Radiographics*. 2022;42(2):359-378. doi:10.1148/rg.210095
5. Safai Zadeh E, Görg C, Prosch H, Horn R, Jenssen C, Dietrich CF. The Role of Thoracic Ultrasound for Diagnosis of Diseases of the Chest Wall, the Mediastinum, and the Diaphragm-Narrative Review and Pictorial Essay. *Diagnostics (Basel)*. 2023;13(4):767. Published 2023 Feb 17. doi:10.3390/diagnostics13040767
6. Kolta MFF, El Rheem NKA, Ibrahim AF, & El-Mageed MRA. The role of MRI in comparison between benign and malignant chest wall masses in correlation with pathology. *Egyptian Journal of Radiology and Nuclear Medicine*. 2021;52. doi:10.1186/s43055-021-00449-6.

Pectus Excavatum and Pectus Carinatum (CH-23)

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Pectus Excavatum and Carinatum

(CH-23.1)

CH.EC.0023.1.C

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- CT Chest without contrast (CPT[®] 71250) or MRI Chest without and with contrast (CPT[®] 71552) and 3-D reconstruction (CPT[®] 76377) if:
 - candidates for surgical correction.
 - cardiac or pulmonary dysfunction has been identified
 - ECG and echocardiography if cardiac symptoms or evidence of cardiac function abnormalities.
 - Chest x-ray and PFT's if increasing shortness of breath.

Evidence Discussion

Measurements of the chest, such as the Haller Index, aid in the pre-operative assessment of pectus deformities. Chest CT is commonly used for preoperative planning.¹⁻³ Chest CT can also be utilized to assess cardiac compression or the presence of concomitant thoracic anomalies¹⁻⁴ and allows for 3D reconstruction of the chest wall.⁴ However, CT does carry with it the risk of ionizing radiation.¹⁻⁵ MRI can also be utilized for preoperative planning and does not carry the risk of ionizing radiation³⁻⁵ and allows for possible real-time imaging.⁴ However, MRI has a longer acquisition time, can be complicated by motion artifacts, and is incompatible with some implanted devices and metallic objects.⁵ Chest x-ray has also been used for the pre-operative calculation of pectus indices^{2,4} and has the benefit of reduced radiation exposure as compared to CT.⁴ Studies have shown, however, that it had decreased measurement accuracy in cases of unbalanced asymmetry as compared to CT.⁴

For individuals with cardiac symptoms further workup with ECC and echocardiography is medically necessary.³

For individuals with pulmonary dysfunction further work up with spirometry is medically necessary.³

Background and Supporting Information

- Chest measurements derived from CT Chest, such as the Haller Index or the correction 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.
- The Haller index is calculated using the width of the chest divided by the distance between the posterior surface of the sternum and the anterior surface of the spine.

A Haller index score is normal at 2.5 to 2.7 and severe at 3.25 or greater. The correction index uses an equation of $(b-a)/b \times 100$, in which a is the minimum distance between the anterior spine and the posterior surface of the sternum, and b is the maximum distance between the anterior spine and most anterior internal rib. It yields a percentage that the chest would need to be corrected to achieve normal dimensions, with a normal level being 10% or less.

- Some have suggested that a CXR can replace the CT Chest for Haller Index calculation with a strong correlation and high diagnostic accuracy.
- Expert consensus from The Society of Thoracic Surgeons 2023 recommended that a comprehensive evaluation with spirometry, ECG, and echocardiography be done with any cardio-pulmonary complaint. The Haller index, correction index, pulmonary compression or failed previous repair, in and of itself, was not an indication for surgery. Corrective surgery indications for those with severe pectus excavatum included: progression of deformity, presence of cardio-pulmonary symptoms, mitral valve prolapse, arrhythmia, significant body image disturbances, abnormal PFTs, abnormal cardiac function test, or the presence of cardiac compression on imaging (echo or CT).

References (CH-23)

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1. Abid I, Ewais MM, Marranca J, Jaroszewski DE. Pectus Excavatum: A Review of Diagnosis and Current Treatment Options. *J Am Osteopath Assoc*. 2017;117(2):106-113. doi:10.7556/jaoa.2017.021.
2. Scalise PN, Demehri FR. The management of pectus excavatum in pediatric patients: a narrative review. *Transl Pediatr*. 2023;12(2):208-220. doi:10.21037/tp-22-361.
3. Janssen N, Daemen JHT, van Polen EJ, et al. Pectus Excavatum: Consensus and Controversies in Clinical Practice. *Ann Thorac Surg*. 2023;116(1):191-199. doi:10.1016/j.athoracsur.2023.02.059.
4. Coorens NA, Janssen N, Daemen JHT, et al. Advancements in preoperative imaging of pectus excavatum: a comprehensive review. *J Thorac Dis*. 2024;16(1):696-707. doi:10.21037/jtd-23-662.
5. Sun J, Chen C, Peng Y, et al. Comparison of magnetic resonance imaging and computed tomography to measure preoperative parameters of children with pectus excavatum. *Pediatr Investig*. 2019;3(2):102-109. Published 2019 Jun 25. doi:10.1002/ped4.12132.
6. Duncan Phillips J, Hoover JD. Chest Wall Deformities and Congenital Lung Lesions: What the General/Thoracic Surgeon Should Know. *Surg Clin North Am*. 2022;102(5):883-911. doi:10.1016/j.suc.2022.07.017
7. Daemen JHT, Coorens NA, Hulsewé KWE, et al. Three-dimensional Surface Imaging for Clinical Decision Making in Pectus Excavatum. *Semin Thorac Cardiovasc Surg*. 2022;34(4):1364-1373. doi:10.1053/j.semtcvs.2021.08.002

Pulmonary Arteriovenous Fistula (AVM) (CH-24)

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Pulmonary AVM (CH-24.1)

CH.AV.0024.1.A

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- CT Chest with contrast (CPT® 71260), CT Chest without contrast (CPT® 71250), CTA Chest (preferred modality for pre-intervention planning) (CPT® 71275), or MRA Chest (CPT® 71555) for evaluation of:
 - suspected pulmonary AVM, including individuals with HHT (Hereditary Hemorrhagic Telangiectasia) or who have a first degree relative with HHT
 - 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
 - follow-up of treated AVM's at 6 months post embolization and then every 3-5 years
 - follow-up of untreated AVM's to be determined by treating physician but no more than annually. Usually the interval is 3-5 years due to the slow-growth nature of PAVM's
 - treated or untreated PAVM's with recurrent symptoms

Evidence Discussion

Chest x-ray is the most appropriate initial imaging exam with presentation of hypoxemia or hemoptysis but it does have low sensitivity for pulmonary arteriovenous malformation (PAVM).³

CT chest is the test of choice for diagnosing a PAVM. Contrast may be considered for an atypical nodule/soft tissue lesion on CT chest without contrast and suspicion for a PAVM. CTA chest is the gold standard for defining the vascular anatomy of a previously identified PAVM. It is not routinely used for diagnosis except in the setting of concomitant embolization therapy, diagnostic uncertainty, or pre-intervention planning.³ MRA chest avoids ionizing radiation but is not as sensitive or specific as CT for the diagnosis of PAVM and has limitations detecting PAVM <5mm.³ It has a potential role in younger people with Hereditary Hemorrhagic Telangiectasia (HHT) who may require lifelong surveillance.³

CT chest without contrast may be done to screen for PAVM in people with possible or confirmed Hereditary Hemorrhagic Telangiectasia (HHT).¹ A negative CT chest with or without contrast helps to exclude a clinically significant PAVM.²

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 (such as in individuals with HHT) 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-24)

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1. Faughnan ME, Mager JJ, Hetts SW, et al. Second International Guidelines for the Diagnosis and Management of Hereditary Hemorrhagic Telangiectasia. *Ann Intern Med.* 2020;173(12):989-1001. doi:10.7326/M20-1443
2. Shovlin CL, Condliffe R, Donaldson JW, Kiely DG, Wort SJ; British Thoracic Society Clinical Statement on Pulmonary Arteriovenous Malformations. *Thorax.* 2017;72(12):1154-1163. doi:10.1136/thoraxjnl-2017-210764
3. Expert Panel on Vascular Imaging; Pillai AK, Steigner ML, et al. ACR Appropriateness Criteria® Pulmonary Arteriovenous Malformation (PAVM). *J Am Coll Radiol.* 2024;21(6S):S268-S285. doi:10.1016/j.jacr.2024.02.028
4. Salibe-Filho W, Oliveira FR, Terra-Filho M. Update on pulmonary arteriovenous malformations. *J Bras Pneumol.* 2023;49(2):e20220359. Published 2023 May 1. doi:10.36416/1806-3756/e20220359
5. Lee HN, Hyun D. Pulmonary Arteriovenous Malformation and Its Vascular Mimickers. *Korean J Radiol.* 2022;23(2):202-217. doi:10.3348/kjr.2021.0417

Pulmonary Embolism (PE) (CH-25)

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Pulmonary Embolism (CH-25.1)

CH.PE.0025.1.A

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- CT Chest with contrast with PE protocol (CPT® 71260) or CTA Chest (CPT® 71275) is medically necessary 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:
 - Dyspnea, new onset and otherwise unexplained;
 - Chest pain, pleuritic;
 - Tachypnea
 - AND, with any ONE of the 3:
 - 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

RISK FACTORS**	SYMPTOMS ATTRIBUTED TO PE**
Immobilization via hospitalization or institutional care 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 or myeloproliferative disorder	Right heart strain or failure
Recent history of a long airplane flight	Systolic BP <90
Use of estrogen-based contraceptives (birth control pills), oral estrogen	Syncope
Advanced age (≥70)	Cough
Congestive heart failure, congenital heart disease, hypertension, superficial venous thrombosis, and/or indwelling central vein catheter	Heart Rate >100

RISK FACTORS**	SYMPTOMS ATTRIBUTED TO PE**
Obesity (BMI ≥ 30)	Palpitations
COVID-19 for those post-hospitalization or those within 30 days of diagnosis	
Recurrent pregnancy loss	
COPD	
Thrombotic disorders, antiphospholipid antibody syndrome, and/or autoimmune disease	
Inflammatory bowel disease	
Nephrotic syndrome	
In vitro fertilization (IVF) treatment	

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	

Well's Criteria for Clinical Probability of PE*

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
- Pregnancy is a risk factor for thrombo-embolic events in and of itself. Additional risk factors are not required. Pregnant individuals with suspected PE should proceed with:
 - If signs/symptoms of DVT are present, Doppler studies of the lower extremities (CPT® 93970 bilateral study or CPT® 93971 unilateral study) are medically necessary
 - If no signs/symptoms of DVT, then chest x-ray first.
 - If chest x-ray is normal, then V/Q scan (CPT® 78580 or CPT® 78582) (preferred test), or CTA Chest (CPT® 71275) or CT Chest with contrast with PE protocol (CPT® 71260)
 - If chest x-ray is abnormal or after non-diagnostic V/Q scan or if V/Q scanning is not readily available, then CTA Chest (CPT® 71275) or CT Chest with contrast with PE protocol (CPT® 71260).
- 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) or SPECT/CT (CPT® 78830):
 - Is not a replacement for CTA Chest
 - Is medically necessary 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 ventilation-perfusion lung scan to evaluate for interval change (CPT® 78580)
 - Suspected Chronic thromboembolic disease or Chronic thromboembolic pulmonary hypertension*, usually after 3 months of effective anticoagulation
- Follow-up imaging in stable or asymptomatic individuals with known PE is not medically necessary
- Follow-up imaging with CT Chest with contrast with PE protocol (CPT® 71260) or CTA Chest (CPT® 71275) for ANY of the following indications:
 - Recurrent or persistent 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
- For Pulmonary Artery Hypertension (PAH), see **Pulmonary Artery Hypertension (PAH) – Indications (CD-8.1)** in the Cardiac Imaging Guidelines.

Evidence Discussion

Symptoms and signs of pulmonary embolus (PE) are nonspecific and common; therefore, knowing whom to test for PE is challenging.⁹ In North America, PE is diagnosed in only 5% of people tested for it.⁸ Chest x-ray (CR) is nonspecific but may rule out other causes of dyspnea and chest pain. Avoiding the overuse of imaging tests is important, given the potential harms of radiation exposure, high costs and complications. The pretest clinical probability has an important effect on the predictive value of CT pulmonary angiography (CTPA).⁸ Determining the clinical pretest probability of PE depends on clinical judgment, which lacks standardization and is subjective, or prediction rules.^{8,11} Kahn et al recommend diagnostic imaging in those with a likelihood of PE greater than or equal to 15%, based on the "implicit sense" of the clinician, and either a structured clinical probability score (Wells, Revised or Simplified Geneva score) or a D-dimer above a pre-specified threshold.⁹ Other experts recommend that imaging be done in those with a high pretest probability based on empirical clinical judgment or a prediction rule and in those with a low/intermediate pretest probability and a positive D-dimer.^{8,10} Imaging can be avoided in people with both a structured clinical probability score at or below the given cutoff and a D-dimer below the given cutoff value.⁹ Imaging is likewise not medically necessary in those with a low/intermediate pretest probability based on clinical judgement and a normal D-dimer.^{8,10}

CTPA is highly sensitive and specific and is the imaging method of choice for suspected PE.⁸⁻¹¹ It may also demonstrate other potential causes of the presenting symptoms. CTPA is a CT angiogram with intravenous (IV) contrast. The timing of the scan is tailored so that contrast enhances the pulmonary arterial system to identify potential filling defects. CT with contrast is usually not medically necessary. According to the American College of Radiology, when IV contrast is given during CT acquisition for suspected PE, the study should be performed as a CTPA.¹⁰

Planar V/Q may preferentially be used in outpatients with a low clinical probability of PE and normal CR, in young (especially female) individuals, pregnant women, and individuals with a history of contrast allergy or renal failure.⁸ The proportion of diagnostic V/Q scans is higher in individuals with a normal CXR. A normal V/Q scan has a high negative predictive value, but there is a high proportion of non-diagnostic scans and it cannot provide alternative diagnoses.¹⁰ Abnormal regional lung perfusion may suggest PE but is not specific and requires correlation with ventilation studies or other imaging. Investigators have studied single-photon emission CT (SPECT) to improve the sensitivity and specificity of V/Q scans. Kahn et al state that V/Q SPECT is a low radiation option to minimize lung and breast tissue irradiation in younger individuals.⁹ Some authors believe that V/Q SPECT should be the preferred study in the evaluation

of suspected PE.¹² However, large scale prospective trials are needed to validate SPECT techniques before its widespread incorporation into diagnostic algorithms.⁸ SPECT has over 90% sensitivity and 72-98% specificity, and V/Q SPECT/CT has the highest diagnostic accuracy.¹⁶⁻¹⁸

A normal perfusion scan and a negative CTPA appear equally safe for ruling out PE in pregnancy.⁸ There is debate regarding which is the first test of choice. CTPA is more expensive and exposes the pregnant woman to more radiation than the fetus; V/Q scans have low radiation and no contrast-related side effects.¹³ A compression duplex ultrasound of the lower extremity is medically necessary if there are symptoms/signs of a DVT. If a DVT is diagnosed, anticoagulation can be administered without further imaging. A CXR is medically necessary. An alternative diagnosis may be found, and it can inform the choice between CTPA and a V/Q scan as the next test when there is no clinical evidence of a DVT.¹⁰ If there is no DVT and a CXR is normal, CTPA or a perfusion scan is medically necessary. If the perfusion scan is normal, a ventilation scan may not be needed. If the CXR is abnormal, alternative causes have been considered and PE is still suspected, CTPA is medically necessary.⁸

Acute PE is treated for at least 3 months with anticoagulation. Individuals should have a follow-up visit 2 weeks to 3 months after PE. If symptoms worsen or the diagnosis is complex, follow-up may occur sooner.⁶ Whether anticoagulation is stopped after 3 months or continued indefinitely depends on whether the reduced risk of recurrent venous thromboembolism (VTE) outweighs the increased risk of bleeding.⁸ The risk of recurrent VTE after stopping anticoagulation is related to the risk factor category for the index PE/VTE event. There are many genetic and acquired risk factors for VTE associated with a low, intermediate or high risk of recurrence.^{8,11}

Patency of the pulmonary arterial bed is restored in the majority of people within the first few months, and routine CTPA imaging is not medically necessary.⁸ Konstantinides et al recommend a transthoracic echocardiogram in those with dyspnea or functional limitation at follow up.⁸ If the probability of pulmonary hypertension is felt to be high, planar V/Q is considered the first line imaging test for suspected chronic thromboembolic pulmonary hypertension (CTEPH). CTPA should not be used as a stand alone test to rule out CTEPH. The diagnosis is based upon measurements made during right heart catheterization and mismatched perfusion defects on V/Q scan more than 3 months after an acute PE.⁸

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 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.
- Half to two thirds of individuals with primary thromboembolism have residual pulmonary artery clot at 6 months and 50% remain at one year, depending on modality at follow-up.
- 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.
- Of note, pregnancy is accompanied by a progressive increase in D-dimer levels, and as such, D-Dimer levels may not be helpful to rule-in or rule-out DVT/PE in pregnancy.

Modality	Fetal radiation exposure in mGy
CXR	0.002-0.1
V/Q	0.32 – 0.74
CTPA	0.03 – 0.66

- Compared with V/Q scan, computed tomography pulmonary angiography (CTPA) is associated with a higher radiation dose to the mother: the calculated doses to breast and lung tissue have been estimated to range from 10mGy to 60mGy and 39.5mGy, respectively, with CTPA ,as compared with 0.98mGy to 1.07mGy and 5.7mGy to 13.5mGy, respectively, with V/Q scan.

Pulmonary Embolism Health Equity Considerations

- Black individuals and female individuals have a higher risk of pulmonary embolism.

- Underrepresented racial/ethnic groups are less likely to undergo advanced therapies for pulmonary embolism.
- Several risk factors for pulmonary embolism (e.g., hyperestrogenic state due to oral contraceptives, pregnancy, or HRT) are exclusive to female individuals.
- Individuals with a low socioeconomic status have reduced access to high-quality imaging centers and undergo fewer advanced interventions for pulmonary embolism.

References (CH-25)

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1. Nijkeuter M, Hovens MM, Davidson BL, Huisman MV. Resolution of thromboemboli in patients with acute pulmonary embolism: a systematic review. *Chest*. 2006;129(1):192-197. doi:10.1378/chest.129.1.192.
2. Kearon C, Akl EA, Ornelas J, et al. Antithrombotic Therapy for VTE Disease: CHEST Guideline and Expert Panel Report [published correction appears in *Chest*. 2016 Oct;150(4):988]. *Chest*. 2016;149(2):315-352. doi:10.1016/j.chest.2015.11.026
3. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 196: Thromboembolism in Pregnancy [published correction appears in *Obstet Gynecol*. 2018 Oct;132(4):1068]. *Obstet Gynecol*. 2018;132(1):e1-e17. doi:10.1097/AOG.0000000000002706
4. Leung AN, Bull TM, Jaeschke R, et al. An official American Thoracic Society/Society of Thoracic Radiology clinical practice guideline: evaluation of suspected pulmonary embolism in pregnancy. *Am J Respir Crit Care Med*. 2011;184(10):1200-1208. doi:10.1164/rccm.201108-1575ST
5. Lim W, Le Gal G, Bates SM, et al. American Society of Hematology 2018 guidelines for management of venous thromboembolism: diagnosis of venous thromboembolism. *Blood Adv*. 2018;2(22):3226-3256. doi:10.1182/bloodadvances.2018024828.
6. Rivera-Lebron B, McDaniel M, Ahrar K, et al. Diagnosis, Treatment and Follow Up of Acute Pulmonary Embolism: Consensus Practice from the PERT Consortium. *Clin Appl Thromb Hemost*. 2019;25:1076029619853037. doi:10.1177/1076029619853037.
7. Derenoncourt PR, Felder GJ, Royal HD, et al. Ventilation-Perfusion Scan: A Primer for Practicing Radiologists. *Radiographics*. 2021;41(7):2047-2070. doi:10.1148/rg.20212100600.
8. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J*. 2020;41(4):543-603. doi:10.1093/eurheartj/ehz405.
9. Kahn SR, de Wit K. Pulmonary Embolism. *N Engl J Med*. 2022;387(1):45-57. doi:10.1056/NEJMcp2116489.
10. Expert Panel on Cardiac Imaging, Kirsch J, Wu CC, et al. ACR Appropriateness Criteria® Suspected Pulmonary Embolism: 2022 Update. *J Am Coll Radiol*. 2022;19(11S):S488-S501. doi:10.1016/j.jacr.2022.09.014.
11. Ishaaya E, Tapson VF. Advances in the diagnosis of acute pulmonary embolism. *F1000Res*. 2020;9:F1000 Faculty Rev-44. Published 2020 Jan 24. doi:10.12688/f1000research.21347.1.
12. Currie GM, Bailey DL. V/Q SPECT and SPECT/CT in Pulmonary Embolism. *J Nucl Med Technol*. 2023;51(1):9-15. doi:10.2967/jnmt.122.264880.
13. Kalaitzopoulos DR, Panagopoulos A, Samant S, et al. Management of venous thromboembolism in pregnancy. *Thromb Res*. 2022;211:106-113. doi:10.1016/j.thromres.2022.02.002.
14. Bukhari SMA, Hunter JG, Bera K, et al. Clinical and imaging aspects of pulmonary embolism: a primer for radiologists. *Clin Imaging*. 2025;117:110328. doi:10.1016/j.clinimag.2024.110328
15. Tester J, Hammerschlag G, Irving L, Pascoe D, Rees M. Investigation and diagnostic imaging of suspected pulmonary embolism during pregnancy and the puerperium: A review of the literature. *J Med Imaging Radiat Oncol*. 2020;64(4):505-515. doi:10.1111/1754-9485.13027
16. Bang JI, Lee WW, Cho SG, Choi M, Song YS. The Diagnostic Accuracy of SPECT Imaging in Patients With Suspected Pulmonary Embolism: Systematic Review and Network Meta-analysis. *Clin Nucl Med*. 2024;49(7):637-643. doi:10.1097/RLU.0000000000005167
17. Squizzato A, Venturini A, Pelitti V, et al. Diagnostic Accuracy of V/Q and Q SPECT/CT in Patients with Suspected Acute Pulmonary Embolism: A Systematic Review and Meta-analysis. *Thromb Haemost*. 2023;123(7):700-713. doi:10.1055/a-1986-8878
18. Iftikhar IH, Iftikhar NH, Naeem M, BaHammam A. SPECT Ventilation/Perfusion Imaging for Acute Pulmonary Embolism: Meta-analysis of Diagnostic Test Accuracy. *Acad Radiol*. 2024;31(2):706-717. doi:10.1016/j.acra.2023.06.024
19. Robin P, Le Pennec R, Eddy M, et al. Residual pulmonary vascular obstruction and recurrence after acute pulmonary embolism: a systematic review and meta-analysis of individual participant data. *J Thromb Haemost*. 2023;21(6):1519-1528.e2. doi:10.1016/j.jtha.2023.01.030

20. Takahashi EA, Sista AK, Addison D, et al. Disparities in Current Pulmonary Embolism Management and Outcomes: A Scientific Statement From the American Heart Association. *Circulation*. 2025;151(15):e944-e955. doi:10.1161/CIR.0000000000001306
21. British Thoracic Society Standards of Care Committee Pulmonary Embolism Guideline Development Group. British Thoracic Society guidelines for the management of suspected acute pulmonary embolism. *Thorax*. 2003;58(6):470-483. doi:10.1136/thorax.58.6.470
22. Mount HR, Rich M, Putnam MS. Recurrent Venous Thromboembolism. *Am Fam Physician*. 2022;105(4):377-385.
23. Henriksson P. Cardiovascular problems associated with IVF therapy. *J Intern Med*. 2021;289(1):2-11. doi:10.1111/joim.13136

Pulmonary Hypertension (CH-26)

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Pulmonary Hypertension (CH-26.1)

CH.PH.0026.1.A

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- See the **Pulmonary Artery Hypertension (PAH) – Indications (CD-8.1)**

Subclavian Steal Syndrome (CH-27)

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Subclavian Steal Syndrome – General (CH-27.0)

CH.SS.0027.0.A

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- See **Subclavian Steal Syndrome (PVD-4.1)** for concerns of Subclavian Steal Syndrome in Peripheral Vascular Disease imaging guidelines.

Superior Vena Cava (SVC) Syndrome (CH-28)

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SVC Syndrome (CH-28.1)

CH.SV.0028.1.A

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- For concerns of SVC syndrome, see **Upper Extremity Venous - Imaging (PVD-4.2)** in Peripheral Vascular Disease Imaging guidelines.

Elevated Hemidiaphragm (CH-30)

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Elevated Hemidiaphragm (CH-30.1)

CH.EH.0030.1.A

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- CT Chest with contrast (CPT® 71260) and/or CT Neck with contrast (CPT® 70491) with new diaphragmatic paralysis after:
 - 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.
- Repeat advanced imaging studies in the absence of new signs or symptoms are not medically necessary.

Evidence Discussion

Diaphragmatic dysfunction includes eventration, weakness and paralysis. Diagnosis is based in part on static and dynamic imaging tests.¹ Unilateral diaphragmatic paralysis is often asymptomatic and suspected when an elevated hemidiaphragm is found incidentally on chest x-ray (CR). CR is a simple and effective test to evaluate the pulmonary parenchyma and the diaphragm.¹ CR has a sensitivity of 66.6% and a specificity of 44%.⁴ The positive and negative predictive value of an elevated hemidiaphragm on CR for diaphragmatic dysfunction is 33% and 93%, respectively. The presence of diaphragm elevation is not necessarily a sign of dysfunction, but its absence makes it unlikely.¹

Flouroscopy has traditionally been the gold standard for diagnosing diaphragmatic paralysis since it can visualize the diaphragm throughout the respiratory cycle and during forced inspiratory maneuvers (i.e., the "sniff test"). Some authors now consider US to be the imaging method of choice for the evaluation of diaphragmatic dysfunction.^{1,2} US is non-invasive, portable, quick and does not expose the individual to ionizing radiation. Absence of thickening of the diaphragm during inspiration, absence of caudal movement during normal inspiration or paradoxical movement during the sniff maneuver confirms paralysis.⁴

A common concern is whether there is an underlying serious condition in those individuals with unilateral hemidiaphragm paralysis with no evident etiology after a history, physical exam and CR. Piehler et al concluded that such individuals are unlikely to have an underlying occult malignant or neurologic condition.³ However, Windisch et al recommended that a one-time CT chest be done if there is clinical suspicion of possible malignancy with damage to the phrenic nerve.²

Additional imaging may be needed to rule out conditions which can cause an elevated hemidiaphragm but are not associated with respiratory muscle weakness. For example, abdominal imaging can be done for suspected hepatic abscess, ascites, or splenomegaly.

Background and Supporting Information

- The right hemidiaphragm sits about 2cm 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-30)

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1. Ricoy J, Rodríguez-Núñez N, Álvarez-Dobaño JM, Toubes ME, Riveiro V, Valdés L. Diaphragmatic dysfunction. *Pulmonology*. 2019;25(4):223-235. doi:10.1016/j.pulmoe.2018.10.008.
2. Windisch W, Schönhofer B, Magnet FS, Stoelben E, Kabitz HJ. Diagnostik und Therapie der gestörten Zwerchfellfunktion [Diagnosis and Treatment of Diaphragmatic Dysfunction]. *Pneumologie*. 2016;70(7):454-461. doi:10.1055/s-0042-106694.
3. Piehler JM, Pairolero PC, Gracey DR, Bernatz PE. Unexplained diaphragmatic paralysis: a harbinger of malignant disease?. *J Thorac Cardiovasc Surg*. 1982;84(6):861-864.
4. Laghi FA Jr, Saad M, Shaikh H. Ultrasound and non-ultrasound imaging techniques in the assessment of diaphragmatic dysfunction. *BMC Pulm Med*. 2021;21(1):85. Published 2021 Mar 15. doi:10.1186/s12890-021-01441-6

Thoracic Outlet Syndrome (TOS) (CH-31)

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Thoracic Outlet Syndrome (CH-31.1)

CH.TO.0031.1.A

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- For concerns of Thoracic Outlet Syndrome, see **Thoracic Outlet Syndrome (PVD-4.2)** in Peripheral Vascular Disease Imaging Guidelines.
- For concerns of Neurogenic Thoracic Outlet Syndrome, see **Brachial Plexus (PN-4.1)** in Peripheral Nerve and Neuromuscular Disorders (PNND) Imaging Guidelines.

Lung Transplantation (CH-32)

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Pre-Transplant Imaging Studies (CH-32.1)

CH.LT.0032.1.A

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- Individuals on the waiting list or being considered for the lung transplant can undergo advanced imaging per that institution's protocol, or any of the studies listed below are medically necessary:
 - CT Chest with and without contrast (CPT® 71270), CT Chest with contrast (CPT® 71260), or CT Chest without contrast (CPT® 71250)
 - ECHO
 - Imaging Stress Test (MPI, SE, MRI) or Heart Catheterization (Right and Left); Heart catheterization can also be done after a positive stress test.
 - CTA Chest (CPT® 71275), and/or CTA Abdomen and Pelvis (CPT® 74174) and/or CTA Aorta with bilateral lower extremity run-off (CPT® 75635) is medically necessary (without initial ABI's and/or arterial duplex) for the following individuals:
 - prior abdominal or lower extremity vascular intervention (any timeframe is acceptable)
 - known peripheral artery disease (PAD) from prior imaging
 - current symptoms of claudication, rest pain or gangrene
 - CTA Chest (CPT® 71275) and/or CTA Abdomen and Pelvis (CPT® 74174) and/or CTA Aorta with bilateral lower extremity run-off (CPT® 75635) is medically necessary (after initial ABI's and/or arterial duplex) for the following individuals:
 - Initial ABI's and/or arterial duplex suggest the presence of PAD as evidenced by one of the following:
 - ABI of <0.9
 - presence of plaque
 - presence of vascular calcification, stenosis or occlusion
 - small vessel size on the duplex
 - CT Abdomen and Pelvis with or without contrast (CPT® 74177 or CPT® 74176) for determining extracorporeal membrane oxygenation (ECMO) candidacy
- Other studies that are medically necessary include V/Q scan and Six Minute Walk Test.
- See **Transplant (CD-1.6)** in the Cardiac Imaging Guidelines.

Evidence Discussion

- Computed Tomography (CT) is often performed for evaluation of individuals prior to lung transplantation. CT allows for surgical planning to delineate extent of the disease

and assess for any contraindications to transplant.⁶ CT carries the risk of exposure to iodinated contrast and ionizing radiation.

- Evaluation of donors is commonly performed by chest radiography.^{6,8} Occasionally, evaluation of donors is performed by chest CT to assess for malignancy, pneumonia, emphysema, and other diseases.⁹
- Cardiac evaluation with echo and/or ischemic evaluation (image stress testing or heart catheterization) is medically necessary prior to lung transplantation.
- Extracorporeal Membrane Oxygenation (ECMO) has been increasingly utilized for bridging prior to lung transplantation or as an adjunct procedure post-transplant.^{4,5} Given the risk of vascular complications,³ preoperative evaluation of the vasculature is reasonable. For those that are asymptomatic without previously known peripheral artery disease (PAD), initial work up with ankle-brachial index (ABI) and/or arterial duplex is medically necessary.⁷ For those that are symptomatic, have a history of known PAD (either from prior imaging or previous vascular intervention) or initial work up has suggested the presence of PAD, advanced imaging is medically necessary for further evaluation.⁷

Post-Transplant Imaging Studies (CH-32.2)

CH.LT.0032.2.A

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- CT Chest with and without contrast (CPT® 71270), CT Chest with contrast (CPT® 71260), or CT Chest without contrast (CPT® 71250) is medically necessary for:
 - initial post-transplant follow-up
 - suspected complication, either surgical, medical or infectious, (See **Background and Supporting Information**)
 - worsening PFT's
 - new finding on other imaging, including chest x-ray
- CTA chest (CPT® 71275) is medically necessary for suspected torsion
- See **Transplant (CD-1.6)** in the Cardiac Imaging Guidelines.

Evidence Discussion

- There are no universally accepted follow-up protocols for routine post-transplant surveillance.⁶ CT chest is supported for initial post-transplant follow up.^{1,6} CT carries with it the risk of exposure to iodinated contrast and ionizing radiation.^{8,9}
- Additional follow-up is based on clinical presentation, suspected complication, or findings on other imaging.^{1,6}

Background and Supporting Information

- Complications from lung transplantation are a major cause of morbidity and mortality.
- The three main categories of complications are surgical, medical and infectious.
 - Surgical complications include: anastomotic complications, bronchial dehiscence, bronchial stenosis, pneumothorax, hemothorax, hematoma, wound dehiscence, and infection.
 - Medical complications include: primary graft dysfunction, pulmonary embolism and pulmonary infarction, Tracheobronchomalacia, posttransplant lymphoproliferative disease, primary disease recurrence, and acute and chronic allograft rejection, including bronchiolitis obliterans and restrictive allograft syndrome.
 - Infectious complications include: hospital and community acquired nonmycobacterial pulmonary infections, mycobacterial infections, fungal infections, and viral infections (CMV most common).

Lung Transplant Health Equity Considerations

- The majority of individuals who receive lung transplants in the United States are of White race and are male. Compared to a matched person of another gender or race, these individuals have a higher likelihood of being allocated a lung transplant.

Reference (CH-32)

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1. DeFreitas MR, McAdams HP, Azfar Ali H, Iranmanesh AM, Chalian H. Complications of Lung Transplantation: Update on Imaging Manifestations and Management. *Radiol Cardiothorac Imaging*. 2021;3(4):e190252. Published 2021 Aug 26. doi:10.1148/ryct.2021190252.
2. Mb D, Bao B, Brechot N, et al. Extracorporeal Life Support Organization (ELSO) Ultrasound Guidance for Extra-Corporeal Membrane Oxygenation Veno-Venous ECMO Specific Guidelines. http://www.else.org/Portals/0/Files/else_Ultrasoundguidance_vvecmo_guidelines_MAY2015.pdf.
3. Bonicolini E, Martucci G, Simons J, et al. Limb ischemia in peripheral veno-arterial extracorporeal membrane oxygenation: a narrative review of incidence, prevention, monitoring, and treatment. *Crit Care*. 2019;23(1):266. Published 2019 Jul 30. doi:10.1186/s13054-019-2541-3.
4. Hoetzenecker K, Benazzo A, Stork T, et al. Bilateral lung transplantation on intraoperative extracorporeal membrane oxygenator: An observational study. *J Thorac Cardiovasc Surg*. 2020;160(1):320-327.e1. doi:10.1016/j.jtcvs.2019.10.155.
5. Faccioli E, Terzi S, Pangoni A, et al. Extracorporeal membrane oxygenation in lung transplantation: Indications, techniques and results. *World J Transplant*. 2021;11(7):290-302. doi:10.5500/wjt.v11.i7.290.
6. Kim SJ, Azour L, Hutchinson BD, et al. Imaging Course of Lung Transplantation: From Patient Selection to Postoperative Complications. *Radiographics*. 2021;41(4):1043-1063. doi:10.1148/rg.2021200173.
7. Gerhard-Herman MD, Gornik HL, Barrett C, et al. 2016 AHA/ACC Guideline on the Management of Patients With Lower Extremity Peripheral Artery Disease: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines [published correction appears in *Circulation*. 2017 Mar 21;135(12):e790. doi: 10.1161/CIR.0000000000000501]. *Circulation*. 2017;135(12):e686-e725. doi:10.1161/CIR.0000000000000470.
8. Calvert AD, Hazelton TR. Role of imaging in lung transplantation evaluation. *J Thorac Dis*. 2020;12(9):5147-5158. doi:10.21037/jtd.2019.08.35
9. Kim SJ, Short RG, Beal MA, Byers DE, Javidan C, Raptis D. Imaging of Lung Transplantation. *Clin Chest Med*. 2024;45(2):445-460. doi:10.1016/j.ccm.2024.02.014
10. Riley LE, Lascano J. Gender and racial disparities in lung transplantation in the United States. *J Heart Lung Transplant*. 2021;40(9):963-969. doi:10.1016/j.healun.2021.06.004

Lung Cancer Screening (CH-33)

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U.S. Preventive Services Task Force: Lung Cancer Screening (CH-33.1)

CH.CS.0033.1.A

v1.0.2026

- Low-dose CT Chest (CPT® 71271) for lung cancer screening in asymptomatic individuals* annually when all of the following criteria have been met:

Screening Indications	Imaging Study
• All criteria below must be met: ◦ Individual has not received a low-dose CT lung screening in less than 12 months; and ◦ Individual has NO health problems that substantially limit life expectancy or the ability or willingness to have curative lung surgery**; and ◦ Individual is between 50 and 80 years of age; and ◦ Individual has at least a 20 pack-year history of cigarette smoking; and ◦ Currently smokes or quit within the past ≤15 years	Low-Dose CT Chest without contrast (CPT® 71271)

For those that no longer qualify for annual LDCT for lung cancer screening but have known lung nodules, follow criteria for follow-up under CH-16. For example, a nodule that is new on the last screening LDCT may warrant continued diagnostic CT evaluation per CH-16.2.

*Symptoms of lung cancer (e.g., hemoptysis, unexplained cough, and/or unexplained weight loss of >15 pounds in the past year) warrant diagnostic evaluation, not screening.

**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."

Lung Cancer Screening Health Equity Considerations

- Black men, individuals with lower levels of education, and individuals with lower household income levels are less likely to be eligible for screening.
- Among individuals who are eligible for lung cancer screenings, Black individuals and those with a lower socioeconomic status are screened at a lower rate and have lower adherence to screening follow-up. This could be attributed to differences in referral rates among providers.
- Barriers to lung cancer screenings include:
 - Individual-level barriers, such as limited knowledge about screening, lack of education and recommendations from providers, distrust of the medical system, and lack of transportation
 - Provider-level barriers, such as lack of knowledge about screening recommendations and lack of time for shared decision-making
 - System-level barriers, such as misconceptions about screening requirements, lack of scanners, limited resources, and low reimbursement rates

Incidental Pulmonary Nodules Detected on Low Dose CT Chest (LDCT) Images (CH-33.3)

CH.CS.0033.3.A

v1.0.2026

- Any Lung-RADS requiring less than 1 year interval follow-up is coded as Low-Dose CT Chest (CPT® 71250) (Not CPT® 71271 which is ONLY the annual screen)
- For lung nodules, including incidental findings from studies other than screening LDCT, or if no longer qualify for screening LDCT, see **Incidental Pulmonary Nodules Detected on CT Images (CH-16.2)**.

Lung-RADS Primary Category/ Category Descriptor	Management
0: Incomplete	If findings suggestive of an inflammatory or infectious process, follow-up with LDCT (CPT® 71250) in 1-3 months
1: Negative - very low likelihood of becoming a clinically active cancer	Annual LDCT screening (CPT® 71271) in 12 months
2: Benign appearance or behavior - very low likelihood of becoming a clinically active cancer due to size or lack of growth	Annual LDCT screening (CPT® 71271) in 12 months
3: Probably benign finding(s) - short term follow-up suggested; includes nodules with a low likelihood of becoming a clinically active cancer	6 month LDCT (CPT® 71250) and if unchanged on this CT it is coded as category 2 and returned to annual LDCT screening (CPT® 71271) in 12 months

Lung-RADS Primary Category/ Category Descriptor	Management
4A: Suspicious - Findings for which additional diagnostic testing and/or tissue sampling is recommended	PET/CT (CPT® 78815) when there is a ≥ 8 mm solid nodule or solid-component Follow-up with LDCT (CPT® 71250) in 3 months and if stable or decreased in size on this CT, it is coded as category 3 with follow-up LDCT (CPT® 71250) at 6 months, if stable or decreased in size on this CT, return to annual LDCT screening (CPT® 71271) in 12 months
4B or 4X: Suspicious - Findings for which additional diagnostic testing and/or tissue sampling is recommended	CT Chest with or without contrast, PET/CT (CPT® 78815), and/or tissue sampling depending on the probability of malignancy and comorbidities. PET/CT (CPT® 78815) when there is a ≥ 8 mm solid component. If there is low suspicion of lung cancer, follow-up with LDCT (CPT® 71250) in 3 months with another LDCT (CPT® 71250) in 6 months and if unchanged on this CT return to annual LDCT screening (CPT® 71271) in 12 months

For those that no longer qualify for annual LDCT for lung cancer screening but have known lung nodules, see criteria for follow-up under CH-16. For example, a nodule that is new on the last screening LDCT may warrant continued diagnostic CT evaluation per **CH-16.2**.

Evidence Discussion

- Low-dose computed tomography (LDCT) Chest for lung cancer screening has been shown to have sensitivity ranging from 59% to 100%, a specificity of 26.4% to 99.7%, a negative predictive value of 97.7% to 100% and a positive predictive value from 3.3% to 43.5%.² The benefit of lung cancer screening is early detection and treatment. The NLST trial showed a relative risk reduction in lung cancer mortality of 20%.² The radiation dose of a LDCT is typically 10% to 30% of a standard-dose CT.² The harms of a screening program would include false-positive results and subsequent unnecessary tests and procedures, the exposure to ionizing radiation and ensuing radiation-induced cancer, and increased anxiety and distress.²

- The risk of malignancy associated with a Lung CT Screening Reporting and Data System (Lung-RADS) score is as follows: a score of 2 is <1%; a score of 3 is 1%-2%; a score of 4A is 5%-15%; a score of 4B and 4X is >15%.³ The American College of Radiology (ACR) recommends follow up imaging of incidental pulmonary nodules detected on low dose lung cancer screening CT's based on the Lung-RADS score;^{3,5} however, there is limited data on the impact of screening intervals.⁵ The NLST and NELSON studies demonstrating reduction in lung cancer mortality were based on screening intervals of 1 year and 1, 3, and 5.5 years, respectively.⁵ Multiple studies have shown that the 3 month follow up recommended for Lung-RADS 4A nodules is optimal, but have raised concerns on stepwise downgrading of a stable 4A nodule to a Lung-RAD 2.⁵ Therefore the ACR has modified follow up intervals with stepped management using the following criteria:
 - Nodules that are stable or decreased at follow-up are downgraded to the next lower Lung-RADS category.⁵
 - Nodules that completely resolve or are proven benign after an appropriate diagnostic evaluation are reclassified based on the most concerning finding.⁵
 - Follow-up recommendations are timed from the current examination.⁵

For further specific details concerning Lung-RADS, see v2022 by the ACR.³

References (CH-33)

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1. Christensen J, Prosper AE, Wu CC, et al. ACR Lung-RADS v2022: Assessment Categories and Management Recommendations. *Chest*. 2024;165(3):738-753. doi:10.1016/j.chest.2023.10.028.
2. US Preventive Services Task Force. Screening for Lung Cancer: US Preventive Services Task Force Recommendation Statement. *JAMA*. 2021;325(10):962–970. doi:10.1001/jama.2021.1117.
- 3.
4. Lung-RADS™ Version 1.1 Assessment Categories Release date: 2022. <https://www.acr.org/-/media/ACR/Files/RADS/Lung-RADS/Lung-RADS-2022.pdf>.
5. Wolf AMD, Oeffinger KC, Shih TY, et al. Screening for lung cancer: 2023 guideline update from the American Cancer Society. *CA Cancer J Clin*. 2024;74(1):50-81. doi:10.3322/caac.21811.
6. Christensen J, Prosper AE, Wu CC, et al. ACR Lung-RADS v2022: Assessment Categories and Management Recommendations. *J Am Coll Radiol*. 2024;21(3):473-488. doi:10.1016/j.jacr.2023.09.009.
7. Sosa E, D'Souza G, Akhtar A, et al. Racial and socioeconomic disparities in lung cancer screening in the United States: A systematic review. *CA Cancer J Clin*. 2021;71(4):299-314. doi:10.3322/caac.21671
8. Kunitomo Y, Bade B, Gunderson CG, et al. Evidence of Racial Disparities in the Lung Cancer Screening Process: a Systematic Review and Meta-Analysis. *J Gen Intern Med*. 2022;37(14):3731-3738. doi:10.1007/s11606-022-07613-2
9. Kunitomo Y, Bade B, Gunderson CG, et al. Racial Differences in Adherence to Lung Cancer Screening Follow-up: A Systematic Review and Meta-analysis. *Chest*. 2022;161(1):266-275. doi:10.1016/j.chest.2021.07.2172
10. Hasson RM, Bridges CJ, Curley RJ, Erhunmwunsee L. Access to Lung Cancer Screening. *Thorac Surg Clin*. 2023;33(4):353-363. doi:10.1016/j.thorsurg.2023.03.003