

**American College of Radiology
ACR Appropriateness Criteria®
Routine Chest Imaging**

Variant 1: Routine chest imaging for hospital admission. No clinical concern for cardiopulmonary disease. Initial Imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	Usually Not Appropriate	⊕
MRI chest without and with IV contrast	Usually Not Appropriate	○
MRI chest without IV contrast	Usually Not Appropriate	○
CT chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

Variant 2: Routine preoperative chest imaging for noncardiothoracic surgery. No history of chronic cardiopulmonary disease or cardiothoracic surgery. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	Usually Not Appropriate	⊕
MRI chest without and with IV contrast	Usually Not Appropriate	○
MRI chest without IV contrast	Usually Not Appropriate	○
CT chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

Variant 3:**Routine preoperative chest imaging for noncardiothoracic surgery. History of chronic cardiopulmonary disease or cardiothoracic surgery. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	May Be Appropriate	⊕
MRI chest without and with IV contrast	Usually Not Appropriate	○
MRI chest without IV contrast	Usually Not Appropriate	○
CT chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

Variant 4:**Routine chest imaging. History of chronic cardiopulmonary disease with stable clinical findings. Surveillance chest imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	May Be Appropriate	⊕
CT chest without IV contrast	May Be Appropriate	⊕⊕⊕
MRI chest without and with IV contrast	Usually Not Appropriate	○
MRI chest without IV contrast	Usually Not Appropriate	○
CT chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest with IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA chest without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

ROUTINE CHEST IMAGING

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Summary of Literature Review

Introduction/Background

Routine testing is used to identify unknown or subclinical disease. In the preprocedural setting, routine testing has been used to identify and evaluate patients who may be at higher risk for complications related to surgery or anesthesia. In addition to laboratory blood testing or physiologic testing (such as electrocardiogram, pulmonary function tests/spirometry), imaging procedures have become a part of the routine testing process. Multiple studies have investigated the use of chest imaging as a routine test, with most finding routine chest imaging to be of little or questionable use. Routine chest imaging does not include imaging performed in the setting of acute illness or for specific clinical questions and does not apply to lung cancer screening (see the ACR Appropriateness Criteria[®] topic on “[Lung Cancer Screening](#)” [1] for further guidance).

Historically, routine chest radiography served as a method of screening a general population for disease. Early use of routine chest imaging was used to identify tuberculosis in asymptomatic individuals for public health and safety measures [2]. However, as the overall rates of undiagnosed tuberculosis have decreased, its usefulness is now being questioned [2]. More recent studies have shown that routine imaging in an otherwise healthy and asymptomatic population has a low diagnostic yield [3,4]. Preprocedural routine imaging has also been used for detection of subclinical disease, such as malignant neoplasms, emphysema, or cardiovascular disease, that could be associated with perioperative complications [2]. Multiple studies have shown that routine imaging studies in the preoperative setting have no significant impact on the decision to operate [5] and usually do not yield information that is not available by clinical history or physical examination [6]. However, there are no randomized control trials to show whether routine chest imaging improves outcomes. This document reviews the use of routine chest imaging performed on adult patients for evaluation on hospital admission, preoperative preparation, and asymptomatic outpatient follow-up and evaluation.

Special Imaging Considerations

Chest radiography can be performed as a 2-view or a single-view imaging study. A 2-view (posterior-anterior and lateral views) chest radiograph requires that a patient is able to stand and appropriately position their arms to be out of the field of view. Alternatively, a single-view chest radiograph using anterior-posterior technique (also referred to as portable technique) can be performed in a patient who is not ambulatory or unable to tolerate positioning of a posterior-anterior radiograph. However, anterior-posterior/portable technique is associated with lower image quality, distortion of normal structures (eg, magnification of the cardiac silhouette), and higher rates of artifactual findings [7].

For the purposes of distinguishing between CT and CT angiography (CTA), ACR Appropriateness Criteria topics use the definition in the [ACR–NASCI–SIR–SPR Practice Parameter for the Performance and Interpretation of Body Computed Tomography Angiography \(CTA\)](#) [8]:

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The American College of Radiology seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through representation of such organizations on expert panels. Participation on the expert panel does not necessarily imply endorsement of the final document by individual contributors or their respective organization.

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“CTA uses a thin-section CT acquisition that is timed to coincide with peak arterial or venous enhancement. The resultant volumetric dataset is interpreted using primary transverse reconstructions as well as multiplanar reformations and 3-D renderings.”

All elements are essential: 1) timing, 2) reconstructions/reformats, and 3) 3-D renderings. Standard CTs with contrast also include timing issues and reconstructions/reformats. Only in CTA, however, is 3-D rendering a **required** element. This corresponds to the definitions that the CMS has applied to the Current Procedural Terminology codes.

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient’s care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously where each procedure provides unique clinical information to effectively manage the patient’s care).

Discussion of Procedures by Variant

Variant 1: Routine chest imaging for hospital admission. No clinical concern for cardiopulmonary disease. Initial Imaging.

CT Chest With IV Contrast

There is no relevant literature to support the use of CT chest with intravenous (IV) contrast as routine imaging for hospital admission.

CT Chest Without and With IV Contrast

There is no relevant literature to support the use of CT chest without and with IV contrast as routine imaging for hospital admission.

CT Chest Without IV Contrast

CT chest is known to have a higher sensitivity than chest radiography for the detection of pulmonary infections and malignancies. Millor et al [9] performed a retrospective review of 6,516 adult patients who underwent a self-referred whole-body CT (including a CT chest without IV contrast), performed in the absence of specific symptoms and no history of malignancy. The authors found that the incidence of abnormal whole-body CT findings increased with age and found a higher rate of abnormal findings in men. Although most findings were benign, there was a 1.47% rate of primary neoplasm detection, the majority of which were found before metastatic spread. The authors suggested that the early detection of these abnormalities (eg, before metastatic spread of malignancy) allows for earlier intervention and sometimes curative treatment.

A number of incidental and relatively common cardiac abnormalities can be detected on routine CT chest without IV contrast [9,10]. These include pericardial, myocardial, coronary, aortic, and valvular abnormalities.

CTA Chest With IV Contrast

There is no relevant literature to support the use of CTA chest with IV contrast as routine imaging for hospital admission.

CTA Chest Without and With IV Contrast

There is no relevant literature to support the use of CTA chest without and with IV contrast as routine imaging for hospital admission.

FDG-PET/CT Skull Base to Mid-Thigh

There is no relevant literature to support the use of fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)-PET/CT for routine initial chest imaging on hospital admission in the absence of cardiopulmonary disease.

MRI Chest Without and With IV Contrast

There is no relevant literature to support the use of MRI chest without and with IV contrast for routine chest imaging on hospital admission in the absence of cardiopulmonary disease.

MRI Chest Without IV Contrast

There is no relevant literature to support the use of MRI chest without IV contrast as routine imaging for hospital admission in the absence of cardiopulmonary disease.

Radiography Chest

Chest radiography is a commonly ordered study on hospital admission. In a retrospective study by Shimoni et al [11] of 238 patient records and interviews with treating physicians, the investigators found that routine admission chest radiography yielded minimal benefit in patients without respiratory symptoms. In addition, routine admission chest radiography was also associated with false-positive findings, leading to inappropriate hospitalization and unnecessary antibiotic therapy. The authors concluded that admission chest radiography was not warranted in patients without respiratory symptoms but could be considered in patients with an uncertain diagnosis who may present atypically, such as older patients, patients who are immunocompromised, or who cannot communicate symptoms with multiple comorbidities and uncertain diagnosis on admission.

Malnik et al [12] conducted a retrospective investigation of medical records and found that a very small number of admission chest radiographs altered patient management if there was no clinical indication or abnormal physical examination finding. The authors concluded that a routine admission radiograph only altered management if there was a clinical indication for performance or abnormal physical examination findings in the thorax.

Variant 2: Routine preoperative chest imaging for noncardiothoracic surgery. No history of chronic cardiopulmonary disease or cardiothoracic surgery. Initial imaging.

CT Chest With IV Contrast

Patients undergoing evaluation for abdominal solid organ transplant (eg, liver or kidney) are known to have higher rates of intrathoracic diseases, including coronary artery disease, pleural effusions, pulmonary hypertension, and hepatopulmonary syndrome, which may not be clinically apparent [13,14]. Currently, the American Association for the Study of Liver Diseases recommends screening of liver transplant candidates for hepatopulmonary syndrome. This is initially done by pulse oximetry, although CT chest with IV contrast may be pursued to exclude other causes of pulmonary disease [15].

CT Chest Without and With IV Contrast

There is no relevant literature to support the use of CT chest without and with IV contrast for routine preoperative evaluation of patients without cardiopulmonary disease undergoing noncardiothoracic surgery.

CT Chest Without IV Contrast

Patients undergoing evaluation for abdominal solid organ transplant (eg, liver or kidney) are known to have higher rates of intrathoracic diseases, including coronary artery disease, pleural effusions, pulmonary hypertension, and hepatopulmonary syndrome, which may not be clinically apparent [13,14]. Currently, the American Association for the Study of Liver Diseases recommends screening of liver transplant candidates for hepatopulmonary syndrome. This is initially done by pulse oximetry, although CT chest without IV contrast may be pursued to exclude other causes of pulmonary disease [15].

CTA Chest With IV Contrast

There is no relevant literature to support the use of CTA chest with IV contrast for routine preoperative evaluation of patients without cardiopulmonary disease undergoing noncardiothoracic surgery.

CTA Chest Without and With IV Contrast

There is no relevant literature to support the use of CTA chest without and with IV contrast for routine preoperative evaluation of patients without cardiopulmonary disease undergoing noncardiothoracic surgery.

FDG-PET/CT Skull Base to Mid-Thigh

There is no relevant literature to support the use of FDG-PET/CT for routine preoperative evaluation of patients without cardiopulmonary disease undergoing noncardiothoracic surgery.

MRI Chest Without and With IV Contrast

There is no relevant literature to support the use of MRI chest without and with IV contrast for routine preoperative evaluation of patients without cardiopulmonary disease undergoing noncardiothoracic surgery.

MRI Chest Without IV Contrast

There is no relevant literature to support the use of MRI chest without IV contrast for routine preoperative evaluation of patients without cardiopulmonary disease undergoing noncardiothoracic surgery.

Radiography Chest

Multiple guidelines for preoperative chest radiography have been published, largely advocating against the use of routine preoperative chest radiographs for elective surgery [16]. This is based on multiple studies that have shown minimal benefit from the routine use of chest radiography before surgery. Joo et al [17] conducted a systematic literature review to investigate the value of screening chest radiographs before surgery. They found that the diagnostic yield of preoperative chest radiographs in patients <50 years of age is low and are generally not recommended in patients <70 years of age. Most radiologic abnormalities found on preoperative imaging were chronic diseases and did not affect management or outcome [17].

A large retrospective study in 1983 found that preoperative chest radiographs in low-risk patients were unnecessary with only 0.3% of chest radiographs finding a relevant finding [6]; furthermore, these abnormalities were not associated with any perioperative complications or need for additional interventions. However, radiographic abnormalities were more common in patients with known risk factors based on clinical history and examination. The authors contended that clinical evaluation could appropriately predict which patients should undergo preoperative chest radiography and argued against the use of chest radiography for routine preoperative evaluation [6]. A meta-analysis by Archer et al [18] found that unsuspected radiologic findings on routine preoperative chest radiography were rare, occurring in only 1.3% of cases; these rare findings resulted in a change in management in only 0.1% of cases.

Gagner et al [19] performed a retrospective review of 1,000 patients who underwent a preoperative chest radiograph and found that 7.4% of studies were abnormal. Abnormal chest radiographs were more common in older individuals than in younger individuals (30% of patients >50 years of age versus 3% in patients <50 years of age), and there were no changes in clinical outcomes due to chest radiographic findings.

A large, multicenter study found that preoperative radiographs performed in patients undergoing noncardiothoracic surgery rarely influenced the decision to undergo surgery [5]; in fact, 25.7% of cases proceeded to surgery before the radiology report was even available [5]. The authors also found wide variability in the use of preoperative chest radiography between different surgical departments, despite clinical risk factors for cardiopulmonary disease.

Patients undergoing evaluation for abdominal solid organ transplant (eg, liver or kidney) are known to have higher rates of intrathoracic diseases, including coronary artery disease, pleural effusions, pulmonary hypertension, and hepatopulmonary syndrome, which may not be clinically apparent [13,14]. In a study of 341 patients being evaluated for liver transplantation, Bozbas et al [20] determined that 48% of patients had an abnormal chest radiograph. Other studies have shown that increasing severity of liver disease correlates to the degree of abnormality on chest radiography [14]. Currently, the American Association for the Study of Liver Diseases recommends screening of liver transplant candidates for hepatopulmonary syndrome. This is initially done by pulse oximetry, although chest radiography may be pursued to exclude other causes of pulmonary disease [15].

Variant 3: Routine preoperative chest imaging for noncardiothoracic surgery. History of chronic cardiopulmonary disease or cardiothoracic surgery. Initial imaging.

CT Chest With IV Contrast

Patients undergoing evaluation for abdominal solid organ transplant (eg, liver or kidney) are known to have higher rates of intrathoracic diseases, including coronary artery disease, pleural effusions, pulmonary hypertension, and hepatopulmonary syndrome, which may not be clinically apparent [13,14]. Currently, the American Association for the Study of Liver Diseases recommends screening of liver transplant candidates for hepatopulmonary syndrome. This is initially done by pulse oximetry, although CT chest with IV contrast may be pursued to exclude other causes of pulmonary disease [15].

CT Chest Without and With IV Contrast

There is no relevant literature to support the use of CT chest without and with IV contrast for routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.

CT Chest Without IV Contrast

Patients undergoing evaluation for abdominal solid organ transplant (eg, liver or kidney) are known to have higher rates of intrathoracic diseases, including coronary artery disease, pleural effusions, pulmonary hypertension, and hepatopulmonary syndrome, which may not be clinically apparent [13,14]. Currently, the American Association for the Study of Liver Diseases recommends screening of liver transplant candidates for hepatopulmonary syndrome.

This is initially done by pulse oximetry, although CT chest without IV contrast may be pursued to exclude other causes of pulmonary disease [15].

CTA Chest With IV Contrast

There is no relevant literature to support the use of CTA chest with IV contrast for routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.

CTA Chest Without and With IV Contrast

There is no relevant literature to support the use of CTA chest without and with IV contrast for routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.

FDG-PET/CT Skull Base to Mid-Thigh

There is no relevant literature to support the use of FDG-PET/CT for routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.

MRI Chest Without and With IV Contrast

There is no relevant literature to support the use of MRI chest without and with IV contrast for routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.

MRI Chest Without IV Contrast

There is no relevant literature to support the use of MRI chest without IV contrast for routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.

Radiography Chest

In a retrospective cohort study of patients with known cardiothoracic disease, abnormal chest radiographic findings were a common finding [21]. However, a review of preoperative chest radiographs in a general population (performed before a variety of different types of surgeries) found that only 5% of studies had an impact on anesthetic management [22]. The authors suggested that discontinuing the use of routine preoperative chest radiographs did not result in any adverse effects on patient care.

A study of 240 patients with known vascular disease investigated the role of preprocedural chest radiographs before peripheral or coronary angiography. Although nearly half of preprocedural chest radiographs had at least one abnormality, no procedures were postponed or canceled because of the radiographic findings [23].

Given these findings, multiple societal guidelines have been published, largely recommending against the use of routine preoperative chest radiography for patients with known cardiovascular disease. The European Society of Anaesthesia does not recommend routine preoperative chest radiography for elective noncardiac surgery because it rarely changes perioperative course [24]. A practice advisory by the American Society of Anesthesiologists Task Force acknowledged that radiographic abnormalities are higher in older patients and those with stable cardiothoracic disease but did not recommend routine chest radiography in the preanesthesia evaluation of these patients [25]. Evidence generally suggests that most preoperative abnormalities may be predicted by clinical evaluation, although chest radiography may be helpful in patients with known chronic disease or patients >50 years of age [26].

One exception is patients with cardiac implantable electronic devices (implanted cardioverter-defibrillators and pacemakers), in whom certain procedures and surgical instruments can be associated with electromagnetic interference (eg, extracorporeal shock wave lithotripsy, radiofrequency ablation, electrocautery) [27]. In the setting of known cardiovascular disease and implanted electronic device, preoperative/preprocedural chest radiograph may be useful for identification of the device type as well as identification of device location [27-29] because these device-related factors may direct selection of surgical instruments or surgical approach.

Patients undergoing evaluation for abdominal solid organ transplant (eg, liver or kidney) are known to have higher rates of intrathoracic diseases including coronary artery disease, pleural effusions, pulmonary hypertension, and hepatopulmonary syndrome, which may not be clinically apparent [13,14]. In a study of 341 patients being evaluated for liver transplantation, Bozbas et al [20] determined that 48% of patients had an abnormal chest radiograph. Other studies have shown that increasing severity of liver disease correlates to degree of abnormality on chest radiography [14]. Currently, the American Association for the Study of Liver Diseases recommends screening of liver transplant candidates for hepatopulmonary syndrome. This is initially done by pulse oximetry, although chest radiography may be pursued to exclude other causes of pulmonary disease [15].

Variant 4: Routine chest imaging. History of chronic cardiopulmonary disease with stable clinical findings. Surveillance chest imaging.

CT Chest With IV Contrast

There is no relevant literature to support the use of CT chest with IV contrast for surveillance of patients with unspecified chronic, stable cardiopulmonary disease.

CT Chest Without and With IV Contrast

There is no relevant literature to support the use of CT chest without and with IV contrast for surveillance of patients with unspecified chronic, stable cardiopulmonary disease.

CT Chest Without IV Contrast

There is limited research regarding the use of CT chest without IV contrast for surveillance in the setting of unspecified chronic, stable cardiopulmonary disease. Expert panels have reviewed the use of CT chest for routine follow-up of stable lung disease in the specific setting of chronic diffuse lung disease (see the ACR Appropriateness Criteria® topic on “[Diffuse Lung Disease](#)” [30]) and concluded that CT chest without IV contrast is usually appropriate [30,31]. Other applications of CT chest for surveillance of specific chronic diseases such as occupational lung disease (see the ACR Appropriateness Criteria® topic on “[Occupational Lung Diseases](#)” [32]) and pulmonary hypertension (see the ACR Appropriateness Criteria® topic on “[Suspected Pulmonary Hypertension](#)” [33]).

CTA Chest With IV Contrast

There is no relevant literature to support the use of CTA chest with IV contrast for surveillance of patients with unspecified chronic, stable cardiopulmonary disease.

CTA Chest Without and With IV Contrast

There is no relevant literature to support the use of CTA chest without and with IV contrast for surveillance of patients with unspecified chronic, stable cardiopulmonary disease.

FDG-PET/CT Skull Base to Mid-Thigh

There is no relevant literature to support the use of FDG-PET/CT for surveillance imaging in the setting of chronic, stable cardiopulmonary disease.

MRI Chest Without and With IV Contrast

MRI chest without and with IV contrast has potential uses in the evaluation of pulmonary nodules, although MRI chest is not yet considered part of the standard diagnostic work-up [34]. MRI chest is routinely used in the follow-up of cystic fibrosis in other countries but has not been widely adopted for routine use in the United States [34].

MRI Chest Without IV Contrast

Emerging uses for MRI chest include screening for hereditary thoracic masses and evaluation of chronic lung disease [35]. MRI chest is routinely used in the follow-up of cystic fibrosis in other countries but has not been widely adopted for routine use in the United States [34].

Radiography Chest

There is limited research regarding the use of chest radiography for broad surveillance of unspecified chronic, stable cardiopulmonary disease. Expert panels have reviewed the use of chest radiography for routine follow-up of specific chronic cardiopulmonary diseases such as diffuse lung disease (see the ACR Appropriateness Criteria® topic on “[Diffuse Lung Disease](#)” [30]), occupational lung disease (see the ACR Appropriateness Criteria® topic on “[Occupational Lung Diseases](#)” [32]), and pulmonary hypertension (see the ACR Appropriateness Criteria® topic on “[Suspected Pulmonary Hypertension](#)” [33]).

Summary of Recommendations

- **VARIANT 1:** Routine chest imaging on hospital admission is usually not appropriate in the absence of cardiopulmonary disease.
- **VARIANT 2:** Routine preoperative chest imaging is usually not appropriate in patients without cardiopulmonary disease undergoing noncardiothoracic surgery.
- **VARIANT 3:** Radiography chest may be appropriate as initial imaging in the routine preoperative evaluation of patients with chronic cardiopulmonary disease undergoing noncardiothoracic surgery.
- **VARIANT 4:** Radiography chest and CT chest without IV contrast may be appropriate for surveillance chest imaging in the setting of chronic, stable cardiopulmonary disease.

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at <https://acsearch.acr.org/list>. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents go to www.acr.org/ac.

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® [Radiation Dose Assessment Introduction](#) document [36].

Relative Radiation Level Designations		
Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
○	0 mSv	0 mSv
⊕	<0.1 mSv	<0.03 mSv
⊕⊕	0.1-1 mSv	0.03-0.3 mSv
⊕⊕⊕	1-10 mSv	0.3-3 mSv
⊕⊕⊕⊕	10-30 mSv	3-10 mSv
⊕⊕⊕⊕⊕	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies.”

References

1. Donnelly EF, Kazerooni EA, Lee E, et al. ACR Appropriateness Criteria® Lung Cancer Screening. *J Am Coll Radiol* 2018;15:S341-S46.
2. Kerr IH. The preoperative chest X-ray. *Br J Anaesth* 1974;46:558-63.
3. Adeko OO, Ariba AJ, Olatunji AA, Toyobo OO. Routine chest radiograph in pre-employment medical examination for healthcare workers: Time for a review of the protocol. *Niger Postgrad Med J* 2017;24:93-96.
4. Ndi MK, Kimani NM, Onyambu CK. Utility of Routine Chest Radiographs in Kenya. *East Afr Med J* 2014;91:216-8.
5. Preoperative chest radiology. National study by the Royal College of Radiologists. *Lancet* 1979;2:83-6.
6. Rucker L, Frye EB, Staten MA. Usefulness of screening chest roentgenograms in preoperative patients. *Jama* 1983;250:3209-11.
7. Skinner S. Guide to thoracic imaging. *Aust Fam Physician* 2015;44:558-62.
8. American College of Radiology. ACR–NASCI–SIR–SPR Practice Parameter for the Performance and Interpretation of Body Computed Tomography Angiography (CTA). Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/body-cta.pdf>. Accessed November 30, 2022.
9. Millor M, Bartolome P, Pons MJ, et al. Whole-body computed tomography: a new point of view in a hospital check-up unit? Our experience in 6516 patients. *Radiol Med* 2019;124:1199-211.
10. Kanza RE, Allard C, Berube M. Cardiac findings on non-gated chest computed tomography: A clinical and pictorial review. *Eur J Radiol* 2016;85:435-51.
11. Shimoni Z, Rosenberg M, Amit L, From P. Chest Radiography Should Be Requested Only on Admission Based on Clinical Grounds. *South Med J* 2020;113:20-22.
12. Malnick S, Duek G, Beilinson N, et al. Routine chest X-ray on hospital admission: does it contribute to diagnosis or treatment? *Isr Med Assoc J* 2010;12:357-61.
13. Martinez-Palli G, Cardenas A. Pre operative cardio pulmonary assessment of the liver transplant candidate. *Ann Hepatol* 2011;10:421-33.
14. Prediletto R, Catapano G, Bottai M, et al. Role of the chest radiograph in the preoperative assessment of the pulmonary function in patients with cirrhosis candidates to liver transplant. *Radiol Med* 2004;108:320-34.
15. Martin P, DiMartini A, Feng S, Brown R, Jr., Fallon M. Evaluation for liver transplantation in adults: 2013 practice guideline by the American Association for the Study of Liver Diseases and the American Society of Transplantation. *Hepatology* 2014;59:1144-65.
16. Young EM, Farmer JD. Preoperative Chest Radiography in Elective Surgery: Review and Update. *S D Med* 2017;70:81-87.
17. Joo HS, Wong J, Naik VN, Savoldelli GL. The value of screening preoperative chest x-rays: a systematic review. *Can J Anaesth* 2005;52:568-74.
18. Archer C, Levy AR, McGregor M. Value of routine preoperative chest x-rays: a meta-analysis. *Can J Anaesth* 1993;40:1022-7.
19. Gagner M, Chiasson A. Preoperative chest x-ray films in elective surgery: a valid screening tool. *Can J Surg* 1990;33:271-4.

20. Bozbas SS, Yilmaz EB, Dogrul I, et al. Preoperative pulmonary evaluation of liver transplant candidates: results from 341 adult patients. *Ann Transplant* 2011;16:88-96.
21. den Harder AM, de Heer LM, de Jong PA, Suyker WJ, Leiner T, Budde RPJ. Frequency of abnormal findings on routine chest radiography before cardiac surgery. *J Thorac Cardiovasc Surg* 2018;155:2035-40.
22. Charpak Y, Blery C, Chastang C, Szatan M, Fourgeaux B. Prospective assessment of a protocol for selective ordering of preoperative chest x-rays. *Can J Anaesth* 1988;35:259-64.
23. Grier DJ, Watson LJ, Hartnell GG, Wilde P. Are routine chest radiographs prior to angiography of any value? *Clin Radiol* 1993;48:131-3.
24. De Hert S, Staender S, Fritsch G, et al. Pre-operative evaluation of adults undergoing elective noncardiac surgery: Updated guideline from the European Society of Anaesthesiology. *Eur J Anaesthesiol* 2018;35:407-65.
25. Committee on S, Practice P, Apfelbaum JL, et al. Practice advisory for preanesthesia evaluation: an updated report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation. *Anesthesiology* 2012;116:522-38.
26. Qaseem A, Snow V, Fitterman N, et al. Risk assessment for and strategies to reduce perioperative pulmonary complications for patients undergoing noncardiothoracic surgery: a guideline from the American College of Physicians. *Ann Intern Med* 2006;144:575-80.
27. Stone ME, Salter B, Fischer A. Perioperative management of patients with cardiac implantable electronic devices. *Br J Anaesth* 2011;107 Suppl 1:i16-26.
28. Crossley GH, Poole JE, Rozner MA, et al. The Heart Rhythm Society (HRS)/American Society of Anesthesiologists (ASA) Expert Consensus Statement on the perioperative management of patients with implantable defibrillators, pacemakers and arrhythmia monitors: facilities and patient management: executive summary this document was developed as a joint project with the American Society of Anesthesiologists (ASA), and in collaboration with the American Heart Association (AHA), and the Society of Thoracic Surgeons (STS). *Heart Rhythm* 2011;8:e1-18.
29. Healey JS, Merchant R, Simpson C, et al. Society position statement : Canadian Cardiovascular Society/Canadian Anesthesiologists' Society/Canadian Heart Rhythm Society joint position statement on the perioperative management of patients with implanted pacemakers, defibrillators, and neurostimulating devices. *Can J Anaesth* 2012;59:394-407.
30. Hobbs SB, Chung JH, Walker CM, et al. ACR Appropriateness Criteria® Diffuse Lung Disease. *J Am Coll Radiol* 2021;18:S320-S29.
31. Lee AS, Scofield RH, Hammitt KM, et al. Consensus Guidelines for Evaluation and Management of Pulmonary Disease in Sjogren's. *Chest* 2021;159:683-98.
32. Cox CW, Chung JH, Ackman JB, et al. ACR Appropriateness Criteria® Occupational Lung Diseases. *J Am Coll Radiol* 2020;17:S188-S97.
33. Sirajuddin A, Donnelly EF, Crabtree TP, et al. ACR Appropriateness Criteria® Suspected Pulmonary Hypertension. *J Am Coll Radiol* 2017;14:S350-S61.
34. Hatabu H, Ohno Y, Geftter WB, et al. Expanding Applications of Pulmonary MRI in the Clinical Evaluation of Lung Disorders: Fleischner Society Position Paper. *Radiology* 2020;297:286-301.
35. Ackman JB. A practical guide to nonvascular thoracic magnetic resonance imaging. *J Thorac Imaging* 2014;29:17-29.
36. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: <https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf>. Accessed November 30, 2022.

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.