



Complete Summary

GUIDELINE TITLE

Hemoptysis.

BIBLIOGRAPHIC SOURCE(S)

Winer-Muram HT, Kahn A, Aquino SL, Batra PV, Gurney JW, Haramati LB, MacMahon H, Mohammed TL, Rozenshtein A, Vydareny KH, Washington L, Woodard PK, Kaiser L, Raof S, Expert Panel on Thoracic Imaging. Hemoptysis. [online publication]. Reston (VA): American College of Radiology (ACR); 2006. 6 p. [18 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Fleishon H, Westcott J, Davis SD, Gefer WB, Henschke CI, McLoud TC, Pugatch RD, Sostman HD, Tocino I, White CS, Yankelevitz D, Bode FR, Goodman LR. Hemoptysis. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215 (Suppl):631-5.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

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SCOPE

DISEASE/CONDITION(S)

Hemoptysis

GUIDELINE CATEGORY

Diagnosis
Evaluation

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Pulmonary Medicine
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for patients with hemoptysis

TARGET POPULATION

Patients with hemoptysis

INTERVENTIONS AND PRACTICES CONSIDERED

1. X-ray, chest
2. Computed tomography (CT), chest, with or without contrast
3. CT angiography (CTA), chest
4. Multidetector CT (MDCT) angiography
5. Invasive (INV), lung, bronchial artery embolization

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY**METHODS USED TO COLLECT/SELECT EVIDENCE**

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed for reaching agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by the Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Hemoptysis

Variant 1: Two risk factors (>40 years old and >40 pack-year history).

Radiologic Procedure	Appropriateness Rating	Comments
X-ray, chest	9	Baseline. Repeat chest x-rays when clinically indicated. In certain clinical settings, may not need to proceed to CT imaging.
CT, chest, with or without contrast	9	Without contrast may be performed to simply localize bleeding site prior to bronchoscopy. With contrast—may show source of bleeding and not need CTA.
CTA, chest	5	To evaluate source of bleeding (i.e., systemic or pulmonary artery vascular supply). If contrast enhanced MDCT is

Radiologic Procedure	Appropriateness Rating	Comments
		performed, CTA may not be needed.
<i>Appropriateness Criteria Scale</i> 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Persistent/recurrent hemoptysis and two risk factors (>40 years old, >40 pack-year history).

Radiologic Procedure	Appropriateness Rating	Comments
X-ray, chest	9	Baseline. Repeat chest x-rays when clinically indicated, (e.g., during episodes of recurrent hemoptysis). In certain clinical settings, may not need to proceed to CT imaging (e.g., diagnosis of chronic bronchitis).
CT, chest, with or without contrast	9	Without contrast - to localize bleeding site prior to bronchoscopy. With contrast - may show source of bleeding and not need CTA.
CTA, chest	6	With contrast - to evaluate source of bleeding (i.e., systemic or pulmonary artery vascular supply). If contrast enhanced MDCT is performed, CTA may not be needed.
<i>Appropriateness Criteria Scale</i> 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Massive hemoptysis without cardiopulmonary compromise.

Radiologic Procedure	Appropriateness Rating	Comments
X-ray, chest	9	Portable if patient unstable.
INV, lung, bronchial	8	If clinically feasible.

Radiologic Procedure	Appropriateness Rating	Comments
artery embolization		
CT, chest, with or without contrast	9	If clinically feasible. Contrast preferred if not contraindicated. With contrast – may show source of bleeding and not need CTA.
CTA, chest	5	If clinically feasible, to evaluate source of bleeding (i.e., systemic or pulmonary artery vascular supply), especially before bronchial artery embolization. If contrast enhanced MDCT is performed, CTA may not be needed.
<i>Appropriateness Criteria Scale</i> 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Hemoptysis is defined as the expectoration of blood that originates from the tracheobronchial tree or pulmonary parenchyma. Life-threatening hemoptysis is rare. Most cases are benign, self-limiting events. However, the presentation of hemoptysis may be a harbinger of significant underlying tracheopulmonary pathology. Common causes of hemoptysis include chronic bronchitis, bronchiectasis, pneumonia, fungal infections, tuberculosis, and malignancy.

The majority of patients will have an identifiable source and etiology for the bleeding at the time of initial diagnosis. Cryptogenic hemoptysis, for which no cause can be identified, is responsible for 3.0%–42.2% of episodes of hemoptysis, particularly in smokers. It is a diagnosis of exclusion and might be expected to decrease in prevalence with more systematic use of computed tomography (CT).

Bronchoscopy versus CT

There is controversy in the literature regarding the use of CT vs. bronchoscopy when further study is indicated. This controversy is further compounded by the lack of a consistent clinical approach for evaluating patients with hemoptysis. Bronchoscopy, performed with either a rigid or a flexible fiberoptic endoscope, is useful in identifying a specific site of bleeding, diagnosing active hemorrhage, and controlling the airway in patients with catastrophic hemorrhage. However, its capacity to help localize the site of bleeding is equivalent to that of radiography or CT, and it is less useful in detecting an underlying disease process. The airways are often filled with blood at the time of bronchoscopy, making evaluation of the distal airways difficult.

Several articles have cited cases of hemoptysis with negative chest radiograph and bronchoscopy in which CT subsequently showed malignancies. In addition, CT can establish the diagnosis of bronchiectasis. Refer to the original guideline document for a brief review of some of the pertinent studies along with their varying conclusions.

Guidelines

Several articles have addressed the need for further evaluation of patients with negative or nonlocalizing chest radiographs. The overall diagnostic yield in this category of patients is low. However, there is a well-recognized 3%–10% incidence of malignancy in this population. One study reported that almost one-quarter of patients presenting with acute hemoptysis secondary to malignancy had normal chest radiographic findings, yet, clear guidelines for the initial workup and follow-up in patients without a definitive diagnosis are missing.

A review study of 119 cases of hemoptysis with negative chest radiographs recommended that patients younger than 40 years old who had negative chest radiographs be managed with observation only.

Another study with 196 patients with negative chest radiographs and subsequent bronchoscopy found by univariate and discriminant analysis three predictors of malignancy. Risk factors were found to include: sex (male), age 50 years or older, and >40 pack year smoking history. If the criteria of two to three risk factors or bleeding, in excess of 30 mL over a period of 24 hours were met, 100% of the cancers would have been found with an overall diagnostic yield of 82%. The use of bronchoscopy would have been reduced by 28%.

In another study, 119 bronchoscopies performed in patients with hemoptysis and negative or nonlocalizing findings on chest radiographs were evaluated. There was no significant difference in the rate of cancers or diagnostic yield at bronchoscopy between patients with normal chest radiograph versus those with nonlocalizing findings. The authors recommended an initial approach of observation and reserving bronchoscopy for persistent hemoptysis, development of focal chest radiograph findings or those at risk for malignancy. They suggested using the risk factors mentioned above but with the lower age limit changed to 40 years.

Another group of researchers reported that for smokers with hemoptysis of unknown origin who are >40 years of age, approximately 6% of them will have a lung cancer that manifests within 3 years. The authors recommend additional follow-up testing in patients presenting with hemoptysis in which the underlying cause was not detected at initial radiography.

In certain cases, it may be useful or even necessary to perform follow-up CT several months after the episode of hemoptysis to study the evolution of underlying parenchymal lung abnormalities or to exclude the possibility that a small malignancy may have been missed at initial CT.

Because of increasing frequency of lung cancer in women (the chance that a man will develop lung cancer is 1 in 13 and for a woman, it is 1 in 17), male gender should not be considered one of the risk factors.

Imaging

The imaging modalities pertinent to the evaluation of hemoptysis include chest radiograph, CT, multidetector CT (MDCT), and thoracic aortography–bronchial artery embolization. There is uniform recognition of the efficacy of chest radiograph in the initial stages of evaluation. Radiography can help lateralize the bleeding with a high degree of certainty and can often help detect underlying parenchymal and pleural abnormalities.

Conditions such as bronchiectasis, lung malignancy, tuberculosis, and chronic fungal infection are some of the most common underlying causes of hemoptysis and are easily detected with CT.

MDCT angiography permits noninvasive, rapid, and accurate assessment of the cause and consequences of hemorrhage into the airways and helps guide subsequent management. Contrast-enhanced MDCT can demonstrate the site of bleeding as accurately as bronchoscopy and detect underlying disease with high sensitivity. MDCT provides for high-resolution angiographic studies of the thoracic and upper abdominal vasculature, which are useful prior to anticipated bronchial artery embolization or surgical intervention.

Bronchial Artery Embolization

Bronchial artery embolization has been shown to be an effective therapy in the control of massive hemoptysis. Nonsurgical interventions for hemoptysis may be used as an interim solution before surgery or may constitute definitive therapy in a patient who is not a candidate for surgery. In over 90% of cases of hemoptysis requiring intervention with arterial embolization or surgery, the bronchial arteries are responsible for the bleeding. Failure to recognize the presence of a nonbronchial systemic arterial supply in patients with massive hemoptysis may result in recurrent bleeding after successful bronchial artery embolization.

Peripheral pulmonary artery pseudoaneurysms occur in up to 11% of patients undergoing bronchial angiography for hemoptysis. Occlusion of the pulmonary artery pseudoaneurysm may require embolization of bronchial or nonbronchial systemic arteries or pulmonary artery branches.

Bronchoscopy before bronchial artery embolization is unnecessary in patients with hemoptysis of known causation if the site of bleeding can be determined from radiographs or CT and no bronchoscopic airways management is needed.

The following guidelines are recommended:

1. Initial evaluation of patients with hemoptysis should include a chest radiograph.
2. Patients at high risk for malignancy (>40 years old, >40 pack-year smoking history) with negative chest radiograph, CT scan, and bronchoscopy can be followed with observation for the following 3 years. Radiography and CT are recommended imaging modalities for the follow-up. Bronchoscopy may complement imaging during the period of observation.

3. In patients who are at high risk for malignancy and have suspicious chest radiograph findings, CT is suggested for initial evaluation.
4. Massive hemoptysis can be effectively treated with either surgery or percutaneous embolization. Contrast enhanced MDCT prior to embolization or surgery will define the source of hemoptysis to be bronchial systemic, nonbronchial systemic and/or pulmonary arterial. Percutaneous embolization may be used initially to halt the hemorrhage prior to definitive surgery.

Abbreviations

- CT, computed tomography
- CTA, computed tomographic angiography
- INV, invasive
- MDCT, multidetector computed tomography

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures for evaluation of patients with hemoptysis

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (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 exams 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 U.S. Food and Drug Administration (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.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Winer-Muram HT, Kahn A, Aquino SL, Batra PV, Gurney JW, Haramati LB, MacMahon H, Mohammed TL, Rozenshtein A, Vydareny KH, Washington L, Woodard PK, Kaiser L, Raoof S, Expert Panel on Thoracic Imaging. Hemoptysis. [online publication]. Reston (VA): American College of Radiology (ACR); 2006. 6 p. [18 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1995 (revised 2006)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Thoracic Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Helen T. Winer-Muram, MD; Arfa Khan, MD; Suzanne L. Aquino, MD; Poonam V. Batra MD; Jud W. Gurney, MD; Linda B. Haramati, MD; Heber MacMahon, MD; Tan-Lucien H. Mohammed, MD; Anna Rozenshtein, MD; Kay H. Vydareny, MD; Lacey Washington, MD; Pamela K. Woodard, MD; Larry Kaiser, MD; Suhail Raof, MBBS

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Fleishon H, Westcott J, Davis SD, Gefter WB, Henschke CI, McLoud TC, Pugatch RD, Sostman HD, Tocino I, White CS, Yankelevitz D, Bode FR, Goodman LR. Hemoptysis. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215 (Suppl):631-5.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

ACR Appropriateness Criteria® *Anytime, Anywhere*™ (PDA application). Available from the [ACR Web site](#).

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

PATIENT RESOURCES

None available

NGC STATUS

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