



## Complete Summary

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### GUIDELINE TITLE

ACR Appropriateness Criteria™ for diagnostic imaging of avascular necrosis of the hip.

### BIBLIOGRAPHIC SOURCE(S)

DeSmet AA, Dalinka MK, Alazraki N, Berquist TH, Daffner RH, el-Khoury GY, Goergen TG, Keats TE, Manaster BJ, Newberg A, Pavlov H, Haralson RH, McCabe JB, Sartoris D. Diagnostic imaging of avascular necrosis of the hip. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun; 215(Suppl):247-54. [41 references]

## COMPLETE SUMMARY CONTENT

SCOPE  
METHODOLOGY - including Rating Scheme and Cost Analysis  
RECOMMENDATIONS  
EVIDENCE SUPPORTING THE RECOMMENDATIONS  
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS  
QUALIFYING STATEMENTS  
IMPLEMENTATION OF THE GUIDELINE  
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT  
CATEGORIES  
IDENTIFYING INFORMATION AND AVAILABILITY

## SCOPE

### DISEASE/CONDITION(S)

Avascular necrosis of the hip

### GUIDELINE CATEGORY

Diagnosis

### CLINICAL SPECIALTY

Emergency Medicine  
Nuclear Medicine  
Orthopedic Surgery  
Radiology

### INTENDED USERS

Health Plans  
Hospitals  
Managed Care Organizations  
Physicians  
Utilization Management

#### GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for avascular necrosis of the hip

#### TARGET POPULATION

- Patients suspected of avascular necrosis of the hip
- Patients with avascular necrosis of the hip

#### INTERVENTIONS AND PRACTICES CONSIDERED

1. Plain films
  - Anteroposterior pelvis radiograph
  - Frogleg lateral radiograph of the hip(s)
  - Cross-table lateral radiograph of the hip(s)
2. Computed tomography
  - Axial images only
  - Axial plus coronal and sagittal reformatted images
3. Radionuclide bone scan
4. Magnetic resonance imaging
5. Magnetic resonance imaging before and after intravenous gadolinium
6. Planar radionuclide bone scan
7. Planar plus single photon emission computed tomography bone scan

#### 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 recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles.

#### 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

Expert Consensus (Delphi Method)  
Weighting According to a Rating Scheme (Scheme Not Given)

#### RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

#### 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 to reach agreement in the formulation of the Appropriateness Criteria. 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 the 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 (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, 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.

#### 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 and the Chair of the ACR Board of Chancellors.

## RECOMMENDATIONS

### MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria™

Clinical Condition: Unilateral or Bilateral Hip Pain

Variant 1: Initial study when avascular necrosis suspected clinically.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Anteroposterior pelvis radiograph	9	Essential for initial evaluation in patients at risk for avascular necrosis who present with hip pain.
Frogleg lateral radiograph of the hip(s)	9	Frogleg view is necessary to evaluate anterosuperior involvement of the femoral head.
Cross-table lateral radiograph of the hip(s)	1	Poor detail due to overlapping soft tissues limits usefulness.
Computed tomography	1	Not useful for initial evaluation.
Radionuclide bone scan	1	Sensitive method for detection of avascular necrosis, but not indicated before plain films.
Magnetic resonance imaging	1	Most sensitive method for detection of avascular necrosis, but not indicated before plain films.

### Appropriateness Criteria Scale

1 2 3 4 5 6 7 8 9

1=Least appropriate 9=Most appropriate

Variant 2: Avascular necrosis with femoral head collapse by plain films in the painful hip: no surgery contemplated at this time.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance imaging	3	May be useful if knowledge of occult avascular necrosis in the opposite hip is needed.
Planar radionuclide bone scan	1	May be useful if knowledge of occult avascular necrosis in the opposite hip is needed and magnetic resonance is not available.
Planar plus single photon emission computed tomography bone scan	1	May be useful if knowledge of occult avascular necrosis in the opposite hip is needed and magnetic resonance is not available.
<b>Computed Tomography</b>		
Axial images only	1	Additional information not provided when compared with conventional plain films.
Axial plus coronal and sagittal reformatted images	1	May be useful if planning osteotomy by defining anatomic localization of the avascular necrosis and the extent of bone deformity.
Magnetic resonance imaging before and after intravenous gadolinium	1	Assessment of perfusion is not needed.
<u>Appropriateness Criteria Scale</u>		
1 2 3 4 5 6 7 8 9		
1=Least appropriate 9=Most appropriate		

Clinical Condition: Unilateral or Bilateral Hip Pain

Variant 3: Avascular necrosis with femoral head collapse by plain films in the painful hip: surgery contemplated.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance imaging	5	May be useful if knowledge of occult avascular necrosis in the opposite hip is needed.
Planar radionuclide bone scan	1	May be useful if knowledge of occult avascular necrosis in the opposite hip is needed and magnetic resonance is not available.
Planar plus single photon emission computed tomography bone scan	1	May be useful if knowledge of occult avascular necrosis in the opposite hip is needed and magnetic resonance is not available.
<b>Computed Tomography</b>		
Axial images only	1	Additional information not provided when compared with conventional plain films.
Axial plus coronal and sagittal reformatted images	1	May be useful if planning osteotomy by defining anatomic localization of the avascular necrosis and the extent of bone deformity.
Magnetic resonance imaging before and after intravenous gadolinium	1	Assessment of perfusion is not needed.
<u>Appropriateness Criteria Scale</u> 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Variant 4: Plain film shows mottled femoral head, suspicious but not definite for avascular necrosis in the painful hip(s). Further clinical evaluation is needed.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance imaging	9	Magnetic resonance imaging provides definitive diagnosis when plain film findings are equivocal.
Planar radionuclide bone	1	Indicated if magnetic resonance

scan		imaging is not available.
Planar plus single photon emission computed tomography bone scan	1	Indicated if magnetic resonance imaging is not available.
<b>Computed Tomography</b>		
Axial image only	1	Less sensitive than bone scanning or magnetic resonance imaging.
Axial plus coronal and sagittal reformatte d images	1	Less sensitive than bone scanning or magnetic resonance imaging.
Magnetic resonance imaging before and after intravenous gadolinium	1	Assessment of perfusion is not needed.
<u>Appropriateness Criteria Scale</u> 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Unilateral or Bilateral Hip Pain

Variant 5: Avascular necrosis suspected clinically but radiographs are normal. Further clinical evaluation needed.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance imaging	9	Most sensitive and specific method to establish or exclude avascular necrosis.
Planar radionuclide bone scan	1	Might be indicated if magnetic resonance imaging is not available or magnetic resonance is negative and avascular necrosis is still suspected.
Planar plus single photon emission computed tomography bone scan	1	Might be indicated if magnetic resonance imaging is not available or magnetic resonance is negative and avascular necrosis is still suspected.

Computed Tomography		
Axial images only	1	Not as sensitive as bone scan or magnetic resonance imaging.
Axial plus coronal and sagittal reformatted images	1	Not as sensitive as bone scan or magnetic resonance imaging.
Magnetic resonance imaging before and after intravenous gadolinium	1	Assessment of perfusion is not needed.
<u>Appropriateness Criteria Scale</u> 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Variant 6: Displaced or nondisplaced by plain films.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Planar radionuclide bone scan	1	Not needed for clinical management and not predictive of later avascular necrosis.
Planar plus single photon emission computed tomography bone scan	1	Not needed for clinical management and not predictive of later avascular necrosis.
Computed Tomography		
Axial images only	1	Not needed for clinical management and not predictive of later avascular necrosis.
Axial plus coronal and sagittal reformatted images	1	Not needed for clinical management and not predictive of later avascular necrosis.
Magnetic resonance imaging	1	Not needed for clinical management and not predictive of later avascular necrosis.

Magnetic resonance imaging before and after intravenous gadolinium	1	If magnetic resonance were to be proven to accurately predict the femoral heads that go on to collapse, evaluation of perfusion may be useful before surgery.
<u>Appropriateness Criteria Scale</u> 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Summary

When a patient who is at high risk for avascular necrosis develops hip pain, the initial examination should consist of an anteroposterior pelvis and frogleg lateral of the symptomatic hip. If the plain film findings are definite for avascular necrosis, magnetic resonance imaging might be indicated only if knowledge of asymptomatic avascular necrosis in the opposite hip is clinically important. If the plain film findings are equivocal for avascular necrosis or are normal in the symptomatic hip, then magnetic resonance imaging is necessary to confirm the diagnosis of avascular necrosis and to exclude other causes for the patient's hip pain. Screening of the patient who is at high risk for avascular necrosis may be of value only if prophylactic treatment of asymptomatic avascular necrosis is proven useful. The use of magnetic resonance imaging with gadolinium enhancement is currently of unproven value in managing patients with acute hip fractures.

Anticipated Exceptions

Clinical factors will certainly play a role in altering the necessity of diagnostic imaging. If the patient at high risk for avascular necrosis has equivocal plain film findings for avascular necrosis, those findings may be adequate for clinical management if the pain is mild and there are no laboratory or clinical findings to suggest underlying infection, tumor, or occult fracture. If the patient with hip pain and at risk for avascular necrosis has a normal plain film, plain films alone may be adequate if the clinical findings are suggestive of a condition such as bursitis. In the future, interventional treatment may be developed that significantly reduces the risk of femoral head collapse in the patient with early avascular necrosis. If so, screening of asymptomatic patients at high risk for avascular necrosis may become clinically appropriate.

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

Appropriate selection of radiologic exam procedures to evaluate patients with or suspected to have avascular necrosis of the hip

### POTENTIAL HARMS

None identified

## 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.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Living with Illness

## IOM DOMAIN

Effectiveness

### IDENTIFYING INFORMATION AND AVAILABILITY

#### BIBLIOGRAPHIC SOURCE(S)

DeSmet AA, Dalinka MK, Alazraki N, Berquist TH, Daffner RH, el-Khoury GY, Goergen TG, Keats TE, Manaster BJ, Newberg A, Pavlov H, Haralson RH, McCabe JB, Sartoris D. Diagnostic imaging of avascular necrosis of the hip. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):247-54. [41 references]

#### ADAPTATION

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

#### DATE RELEASED

1995 (revised 1999)

#### 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

ACR Appropriateness Criteria™ Committee, Expert Panel on Musculoskeletal Imaging.

#### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of Panel Members: Arthur A. DeSmet, MD; Murray K. Dalinka, MD; Naomi Alazraki, MD; Thomas H. Berquist, MD; Richard H. Daffner, MD; George Y. El-Khoury, MD; Thomas G. Goergen, MD; Theodore E. Keats, MD; B.J. Manaster, MD, PhD; Arthur Newberg, MD; Helene Pavlov, MD; Robert H. Haralson, III, MD; John B. McCabe, MD; David Sartoris, MD

#### FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

#### GUIDELINE STATUS

This is the current release of the guideline. It is a revision of a previously issued version (Appropriateness criteria for diagnostic imaging of avascular necrosis of the hip. Reston [VA]: American College of Radiology (ACR); 1995. 8 p. [ACR Appropriateness Criteria™]).

The ACR Appropriateness Criteria™ are reviewed after five years, if not sooner, depending upon introduction of new and highly significant scientific evidence. The next review date for this topic is 2004.

#### GUIDELINE AVAILABILITY

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

Print copies: Available from ACR, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

#### AVAILABILITY OF COMPANION DOCUMENTS

None available

#### PATIENT RESOURCES

None available

#### NGC STATUS

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001.

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