



Complete Summary

GUIDELINE TITLE

Acute onset of scrotal pain (without trauma, without antecedent mass).

BIBLIOGRAPHIC SOURCE(S)

Remer EM, Francis IR, Baumgarten DA, Bluth EI, Bush WH Jr, Casalino DD, Curry NS, Israel GMN, Jafri SZ, Kawashima A, Papanicolaou N, Sandler CM, Spring DB, Fulgham P, Expert Panel on Urologic imaging. Acute onset of scrotal pain-without trauma, without antecedent mass. [online publication]. Reston (VA): American College of Radiology (ACR); 2007. 5 p.

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previous published version: Older RA, Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Jafri SZ, Kawashima A, Kronthal A, Papanicolaou N, Ramchandani P, Rosenfield AT, Sandler C, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Acute onset of scrotal pain (without trauma, without antecedent mass). [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 4 p. [50 references]

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)

Acute onset of scrotal pain

GUIDELINE CATEGORY

Diagnosis
Evaluation

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Nuclear Medicine
Pediatrics
Radiation Oncology
Radiology
Urology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of radiologic examinations in the investigation and diagnosis of patients with acute onset of scrotal pain without trauma, and without antecedent mass

TARGET POPULATION

Male adults and children with acute onset of scrotal pain

Note: This diagnostic appropriateness discussion is limited to patients with acute pain who have no history of trauma and no history of a mass antecedent to the onset of pain.

INTERVENTIONS AND PRACTICES CONSIDERED

1. Ultrasound (US), scrotum
 - Color and/or power Doppler
 - Gray-scale only
2. Nuclear medicine (NUC) scan of the scrotum
 - Ga-167 or In-111 white blood cell (WBC)
 - Infection imaging with Ga-67 or In-111 WBC labeling
3. Magnetic resonance imaging (MRI), scrotum

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

Not stated

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: Acute Onset of Scrotal Pain

Variant: Without trauma, without antecedent mass.

Radiologic Procedure	Rating	Comments	RRL*
US scrotum color Doppler and/or power Doppler	9	Excellent study that is generally available and has high sensitivity and specificity. Operator and equipment	None

Radiologic Procedure	Rating	Comments	RRL*
		dependent. Requires small parts transducer with slow-flow-enhancing techniques. Must be performed in a timely manner. In equivocal situations, power Doppler evaluation of the spermatic cord may be helpful.	
NUC, Ga-67 or In-111 WBC scan, scrotum	7	Well-established study. Interpretative experience and careful technique required. Must be performed in a timely manner.	Med
MRI scrotum	3	May be helpful if other tests inconclusive, but must be performed in short time frame.	None
US scrotum gray-scale only	1	Relatively insensitive to earliest changes secondary to decreased or absent perfusion.	None
NUC infection imaging with Ga-67 or In-111 WBC labeling scrotum	1	Infection diagnosis not obtainable in appropriate time frame. Isolated case reports as incidental finding.	High
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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

Summary of Literature Review

The ability to confidently establish a surgical versus a nonsurgical diagnosis for acute scrotal pain is important. The benefits of early surgery for testicular salvage in ischemic disease, primarily torsion of the spermatic cord, are well known but must be balanced against the costs of operating on the much larger number of patients with nonsurgical disease, primarily acute epididymitis. Although the acute scrotum is defined as acute unilateral scrotal swelling, with or without pain, most patients present with pain as their primary or at least major concurrent complaint. The differential diagnosis of the acute scrotum includes: 1) torsion of the testis, 2) torsion of the testicular appendages, 3) acute epididymitis or epididymoorchitis, 4) mumps orchitis, 5) strangulated hernia, 6) inflammatory type of testicular tumor, 7) acute hydrocele, and 8) traumatic hemorrhage. This diagnostic appropriateness discussion, however, will be limited to patients with acute pain who have no history of trauma and no history of a mass before the onset of pain. A minor traumatic episode may call attention to a scrotal process; and in the adolescent, just becoming aware of his sexuality may be an enabling event for him to voice his symptoms.

Torsion is decidedly rare in patients older than 35 years. Acute epididymitis is commonly the cause of acute pain in patients younger than age 18, very common in patients age 19 to 25, and overwhelmingly the etiology in patients older than age 25. There are enough exceptions to these demographics, particularly in patients younger than age 30 years, such that these statistics must be used with caution. In this group there is also significant overlap in the presence of clinical factors that may favor torsion (abrupt onset, normal urinalysis) or epididymitis (more gradual onset, abnormal urinalysis). Acute scrotal pain in prepubertal boys occurs most commonly from torsion of the testicular appendages, but may clinically mimic testicular torsion or epididymo-orchitis. A pathognomonic physical examination finding ("blue dot sign") is infrequently encountered.

Radionuclide scrotal imaging (RNSI) is an accurate examination in the differential diagnosis of ischemia versus infection. The specificity in the diagnosis of ischemia versus other photon-deficient lesions is slightly lower. Photon-deficient areas secondary to hydrocele, spermatocele, uncommonly edematous appendix testis, and rarely an inguinal hernia can be mistaken for an avascular testis. One study found that 20 of 27 photopenic scrotal lesions were false positives (not torsion) and the ultrasound (US) examination prevented unnecessary surgery in 16 (59%) of these cases. There have been many large series reported. The examination and the technique are well established and reproducible, and most imaging specialists and nuclear medicine technologists have been trained in the performance and interpretation of these examinations. With scintigraphy, some problems arise in infants and very small children whose genitalia are small and therefore difficult to image. Because this examination is performed relatively infrequently in many departments, the experience of individual practitioners may be limited. With increasing use of sonography, experience with RNSI, especially for more recently trained physicians, is decreasing. Availability and time of examination can also be limiting factors.

The imaging of infected scrotal contents, testis, or epididymitis with the radionuclide infection imaging agents Ga-67 or In-111 WBC has been noted in isolated case reports. There is, however, no routine indication for their use.

Color Doppler ultrasound (CDU) is also a valuable exam for evaluating testicular perfusion. Studies in the early 1990s showed a reasonable sensitivity and specificity for diagnosis of torsion comparable to RNSI. The CDU equipment has improved, and experience has increased, with resultant sensitivity and specificity now ranging from approximately 89%-100%. Experience with CDU in evaluating the acute scrotum has increased, both for practicing physicians and for those in training. It is readily available at most, if not all, institutions and can be done quickly without any specific preparations. Power Doppler (US) can be used in place of, or as an adjunct to, CDU. Power Doppler has been shown to demonstrate flow where CDU does not and, in general, to demonstrate slower flow than CDU. Power Doppler US is especially useful to demonstrate intratesticular flow in prepubertal testes.

Doppler US is not without drawbacks, and one area of concern has been its application in the young child and particularly the prepubertal child. Studies in children have shown a sensitivity of 89% and specificity of 100%, but there were technically unsuccessful studies which emphasize the need for experience and proper equipment settings when examining the young child. Settings optimized to

detect slow flow include a small color-sampling box, lowest pulse repetition frequency, and lowest possible threshold setting. Blood flow can occasionally be preserved in patients with torsion. Attention to spectral Doppler waveform patterns (high-resistance arterial waveform, monophasic waveform) and spermatic cord morphology (thick spermatic cord) may help diminish false negative examinations. A multicenter study of 919 patients aged 1-18 years studied for an acute scrotum found false negative CDU studies in 50 of 208 patients with torsion (sensitivity 76%). An abnormal spermatic cord "twist" was identified, however, in 199 of 208 patients (sensitivity 96%). Further, a normal linear cord (705/711, 99% specificity) was found in patients without torsion.

In a comparison of 294 patients with primary scrotal exploration and 332 with US first and exploration if US was positive or there was a high clinical suspicion of torsion, one study found that US could obviate the need for exploration in many patients, and thus minimized and shortened hospital stays.

Gray-scale US alone is capable of evaluating the cystic or solid nature of scrotal masses and often the signs of an inflamed epididymitis and a necrotic testicle, but it is much less sensitive to the earliest changes resulting from decreased or absent testicular perfusion. In the setting of torsion, a normal homogenous echo pattern is, however, likely to indicate a viable testis, whereas a hypoechoic or inhomogeneous testis is likely to be nonviable.

The most common cause of acute scrotal pain in adolescent boys and adults is epididymo-orchitis. Grayscale US combined with color Doppler imaging is the prime imaging means to make this diagnosis. The epididymis is enlarged and may be increased or decreased in echogenicity. Scrotal wall thickening and hydrocele are common. The testis is involved in 20%-40% of cases (epididymo-orchitis). Increased color Doppler flow in the epididymis and, if involved, the testis, is characteristic. The most common cause of acute scrotal pain in the child is torsion of a testicular appendage (appendix epididymis or appendix testis). Reactive changes (hydrocele, epididymal head enlargement, increased color Doppler flow) from torsion of a testicular appendage may mimic epididymitis. The torsed testicular appendage can be difficult to identify with US. It was seen in only 9 of 29 patients (31%) in one study, but it is usually larger, rounder, and has more surrounding flow than normal appendages. Size alone may discriminate torsed from normal testicular appendages with low sensitivity (67%) but high specificity (100%), obviating surgery in some cases.

Magnetic resonance imaging (MRI) techniques has been rarely used in diagnosing the acute scrotum, although reports of its use in scrotal disease are increasing. In one report, 11 patients with subacute signs and symptoms were evaluated, and a differential diagnosis between ischemia in six patients and infection in five patients could be made. In a second study of 39 patients with an acute scrotum and an inconclusive US and physical exam, MRI had a sensitivity of 93% and a specificity of 100% for torsion. Experimental studies also suggest potential use of MRI in acute torsion. Another study suggests that MRI may be useful to identify patients with segmental testicular infarction when US is not conclusive.

Summary

Both CDU and RSNi are valuable techniques for determining the etiology of acute scrotal pain. Although some authors still suggest immediate surgical exploration in patients with a strong clinical impression of testicular ischemia, if either CDU or RNSI is readily available and can be performed within 30–60 minutes of the request to simultaneously prepare an operating room, there is ample evidence that fewer patients with infection will be operated on, and also that patients with an ischemic testis will not be treated with antibiotics for infection. The choice of CDU or RNSI should be based on availability and operator experience. In most institutions, availability and experience will favor CDU. If one performs CDU and there remains a question about a diagnosis, US evaluation of the spermatic cord, MRI, or RNSI may be of value.

Abbreviations

- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- US, ultrasound
- WBC, white blood cell

CLINICAL ALGORITHM(S)

None provided

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 the investigation and diagnosis of patients with acute scrotal pain

POTENTIAL HARMS

- With scintigraphy, some problems arise in infants and very small children whose genitalia are small and therefore difficult to image. Photon-deficient areas secondary to hydrocele, spermatocele, uncommonly edematous appendix testis, and rarely an inguinal hernia can be mistaken on radionuclide scrotal imaging for an avascular testis. Because this examination is performed relatively infrequently in many departments, the experience of individual practitioners may be limited. With increasing use of sonography, experience with radionuclide scrotal imaging (RNSI), especially for more recently trained physicians, is decreasing. Availability and time of examination can also be limiting factors.

- The relative radiation level is high with nuclear medicine (NUC) infection imaging with Ga-67 or In-111 white blood cell (WBC) labeling and medium with NUC Ga-67 or In-111 WBC scan of the scrotum.

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)

Remer EM, Francis IR, Baumgarten DA, Bluth EI, Bush WH Jr, Casalino DD, Curry NS, Israel GMN, Jafri SZ, Kawashima A, Papanicolaou N, Sandler CM, Spring DB, Fulgham P, Expert Panel on Urologic imaging. Acute onset of scrotal pain-without trauma, without antecedent mass. [online publication]. Reston (VA): American College of Radiology (ACR); 2007. 5 p.

ADAPTATION

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

DATE RELEASED

1995 (revised 2007)

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 Urologic Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Erick M. Remer, MD; Isaac R. Francis, MD; Deborah A. Baumgarten, MD; Edward I. Bluth, MD; William H. Bush, Jr., MD; David D. Casalino, MD; Nancy S. Curry, MD; Gary M. Israel, MD; S. Zafar H. Jafri, MD; Akira Kawashima, MD; Nicholas Papanicolaou, MD; Carl M. Sandler, MD; David B. Spring, MD; Pat Fulgham, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previous published version: Older RA, Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Jafri SZ, Kawashima A, Kronthal A, Papanicolaou N,

Ramchandani P, Rosenfield AT, Sandler C, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Acute onset of scrotal pain (without trauma, without antecedent mass). [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 4 p. [50 references]

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 are 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](#).
- ACR Appropriateness Criteria®. Relative radiation level information. 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

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer on June 29, 2001. This summary was updated by ECRI on September 8, 2004. The updated information was verified by the guideline developer on October 8, 2004. This summary was updated by ECRI on February 8, 2006. This NGC summary was updated by ECRI Institute on November 14, 2007.

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