Complete Summary

GUIDELINE TITLE

Renal trauma.

BIBLIOGRAPHIC SOURCE(S)

Sandler CM, Francis IR, Baumgarten DA, Bluth EI, Bush WH Jr, Casalino DD, Curry NS, Israel GM, Jafri SZ, Kawashima A, Papanicolaou N, Remer EM, Spring DB, Fulgham P, Expert Panel on Urologic Imaging. Renal trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2007. 4 p. [24 references]

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previously published version: Sandler CM, Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Jafri SZ, Kawashima A, Kronthal A, Older RA, Papanicolaou N, Ramchandani P, Rosenfield AT, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Renal trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 4 p. [24 references]

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

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Renal trauma

GUIDELINE CATEGORY

Diagnosis
Evaluation

CLINICAL SPECIALTY

Emergency Medicine
Nephrology
Radiology
Urology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of radiologic procedures in the differential diagnosis and evaluation of renal trauma

TARGET POPULATION

Patients with renal trauma

INTERVENTIONS AND PRACTICES CONSIDERED

1. X-ray
    - Abdomen and pelvis
    - Intravenous urography
2. Computed tomography (CT), abdomen and pelvis with contrast
3. Nuclear medicine (NUC) renal scan
4. Ultrasound (US)
    - Abdomen
    - Kidneys
5. Invasive (INV) angiography of the kidney

MAJOR OUTCOMES CONSIDERED

Utility of radiologic procedures in evaluation of renal trauma

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: Renal Trauma.

Variant 1: Blunt abdominal trauma with microscopic hematuria with no suspicion of associated abdominal injury.

Radiologic Procedure	Rating	Comments	RRL*
X-ray abdomen and pelvis	4		Low
CT abdomen and pelvis with contrast	4		High
US abdomen	3		None
US kidneys	3		None

Radiologic Procedure	Rating	Comments	RRL*
X-ray intravenous urography	3		Low
NUC renal scan	1		IP
INV angiography kidney	1		IP
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.

Variant 2: Blunt abdominal injury; suspicion of multisystem trauma, with hematuria.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	8		High
X-ray abdomen and pelvis	8		Low
X-ray intravenous urography	4		Low
INV angiography kidney	4	Embolizing bleeders, avulsion of pedicle.	IP
NUC renal scan	4	Not commonly used for initial trauma.	IP
US abdomen	3		None
US kidneys	3		None
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

No single method of imaging evaluation can be uniformly applied to all patients suspected of suffering abdominal trauma. The exact approach depends not only on the types of injuries the patient has likely suffered, but also on the philosophy of the attending physicians, local practice, and the type of equipment and support available. Moreover, the evaluation of a suspected renal injury cannot be isolated from the evaluation of other suspected intraabdominal injuries. A variety of different approaches to a given patient may therefore be acceptable.

Most closed urinary tract injury occurs after wide-impact blunt abdominal trauma. Isolated renal injuries after blunt trauma are rare, and the majority are relatively minor in most published series. The amount of hematuria that should trigger radiologic investigation of the urinary tract after localized blunt trauma is controversial. Many authorities feel that any amount of hematuria should be investigated, as it is well known that significant urinary tract injury may be present in patients with little or even no hematuria. Furthermore, there is little correlation between the degree of hematuria and the amount of renal injury that is present.

An oft-cited example is patients suffering from renal pedicle injury in whom hematuria is said to be absent in 25% of cases. One group of investigators, however, found that significant renal injury was limited to the group of patients in whom shock and either gross or microscopic hematuria was present among 306 individuals analyzed retrospectively following blunt trauma. There were no significant renal injuries among the 221 patients who had microscopic hematuria but were not suffering from shock.

In patients in the same series who suffered penetrating injuries, however, no such discrimination was possible, and the authors suggest radiologic evaluation of all patients suffering penetrating injury and hematuria. These observations have now been confirmed in multiple additional studies, both retrospectively and prospectively. It can therefore be concluded that investigation of hematuria is warranted in patients with suspected isolated renal injury who 1) have penetrating injury, 2) have gross hematuria, 3) have microscopic hematuria with shock, or 4) are suspected of having major associated intraabdominal injury.

There is no longer much argument that computed tomography (CT) of the abdomen is the screening study of choice for suspected intra-abdominal injury. Many trauma surgeons still regard diagnostic peritoneal lavage (DPL) as a viable method for detecting intraperitoneal hemorrhage. DPL is sensitive, easy to perform, and universally available; however, it does not differentiate inconsequential bleeding from that which requires laparotomy and, more importantly, cannot detect the site of the bleeding. Furthermore, DPL does not detect retroperitoneal injuries and should not be performed in children (because of the risk of injury to the bladder), in those who have had previous laparotomy (because intraabdominal adhesions may cause false negative results), or in those with retroperitoneal hematomas as a result of pelvic fractures (because of potential false positive results). CT is much more specific than DPL for both intraperitoneal and retroperitoneal injuries and, most importantly, can differentiate trivial injuries from those requiring exploration. CT, however, is still not universally available on an immediate basis, is expensive, and is reported to be less sensitive than DPL for detecting injuries to the bowel or mesentery.

Because CT is expensive, not universally available on an immediate basis, and exposes many young patients to ionizing radiation, focused abdominal sonography for trauma (FAST) has been touted by some as an alternative to CT. This method, originally pioneered in Europe, has been now advocated by many in the United States. A sensitivity of 98% for detecting free fluid collections with a specificity of 99% has been reported for US; this same study reported 100% sensitivity and specificity and a positive predictive value for US in detecting renal injuries. The series, however, included only 3 patients with renal injuries.

A significant limitation of US for imaging of renal trauma is that no functional information is provided. Its value in screening abdominal trauma patients has been recently confirmed in a large study. This study reported that among 3,679 patients with negative findings on US, 99.9% were confirmed as true negative by clinical or radiographic follow-up. Of 38 patients with false negative studies, the most commonly missed injuries were retroperitoneal hematomas and injuries of the spleen or liver with little hemoperitoneum. Patients considered at high risk for a false negative study include those with hematuria, fractures of the lower ribs or lumbar spine, and pelvic fractures. There is little information concerning the use of color Doppler for assessing renal blood flow after trauma.

Most blunt renal injuries (75%) occur in patients suffering multisystem trauma. In a series from another study, 241 of 831 patients had what were considered to be solitary renal injuries; however, the vast majority (98%) was minor injuries. Therefore, only five patients in the entire series suffered significant isolated renal injury. There were 33 significant renal injuries in the group of 590 patients with hematuria who suffered multisystem trauma.

Other injuries associated with injury of the kidneys following multisystem blunt trauma include (in order of decreasing frequency): fractures of the extremities, thoracic injury, pelvic fracture, intra-abdominal injury, head injuries, and diaphragmatic rupture. In the abdomen, injuries to the liver and spleen are most commonly associated with renal injury, followed by injury to the pancreas, the colon, and the small bowel.

Studies have shown there is a strong association between the presence of gross hematuria and nonurologic intraabdominal injury from blunt trauma. One group of investigators found that 24% of patients with gross hematuria after blunt trauma had a significant intra-abdominal injury. This percentage increased to 65% when shock was also present.

In patients who are hemodynamically unstable, only limited information about the status of the urinary tract can generally be obtained. A single view of the abdomen following a large dose of intravenously administered contrast material ("one-shot IVP") is generally all that can be obtained; such a study is insufficient to diagnose a renal injury but can give information about the location and status of the uninjured kidney(s). Similarly, most patients suffering from an anterior gunshot wound of the abdomen will require surgical exploration; the goal of imaging in such cases is to establish the gross functional status of the kidneys. The renal injury, if present, will generally be assessed intraoperatively. The value of these limited "one-shot" studies in unstable patients has been questioned; a retrospective review of 239 such studies showed that the preoperative urographic assessment of contralateral renal function played no role in the management of a

renal injury. The authors of this study felt that delaying definitive therapy merely to obtain the urographic study was not justified.

In patients who have suffered suspected penetrating renal injury, CT is also the method of choice for assessment. Some urologists will argue that CT is unnecessary since they believe that all such patients should have renal exploratory surgery; in such cases, the goal of imaging is to exclude an abnormality of the contralateral kidney.

In patients with limited posterior stab wounds, however, CT should be performed for assessment, since exploratory surgery is not mandatory.

In recent years, there has been an increasing trend toward conservative (nonoperative) management of major renal injuries following blunt trauma. At least part of the impetus for this development has been the accurate staging of such injuries that is provided by CT. One group of investigators reported that early CT evaluation allowed confident nonoperative management in 17 of 22 patients with renal injuries. Another group found nonoperative management was effective in 50% of patients with Grade IV or V injuries who were hemodynamically stable. Many authorities now believe that with accurate preoperative CT, renal exploration need not be performed unless there are major devitalized fragments with associated bowel or pancreatic injury or unless the patient becomes hemodynamically unstable from a major renal laceration and is not manageable by angiographic embolization.

The Societe Internationale D'Urologie recently published a consensus document on issues concerning the diagnosis and management of renal injuries. Its recommendations are not substantially different from those in this summary.

Summary

Assessment of the nature and extent of the renal injury is most important in those patients in whom there will be an attempt to avoid exploratory surgery. In hemodynamically stable patients being assessed for wide-impact blunt injury in a major trauma center where CT is available immediately on a 24-hour basis, this goal can most efficaciously be met by abdominal and pelvic CT. In institutions where there would be a significant delay in obtaining high-quality CT, it is perfectly acceptable to use DPL to assess the intraperitoneal viscera and high-dose urography, preferably with tomography, to assess the kidneys. In patients who suffer suspected anterior penetrating renal injury, CT should be used as a first-line study if radiographic assessment is desired. Similarly, CT is the study of choice to evaluate the effect of limited posterior stab wounds.

The preferred treatment of patients with suspected isolated blunt renal injury is perhaps the most controversial issue. Most such patients do not have evidence of multisystem trauma but are suspected of renal injury because of hematuria. Studies have demonstrated that the incidence of significant renal injury in this group of patients is low; those with microscopic hematuria alone do not need any radiologic evaluation.

Anticipated Exceptions

In pregnant patients, US should be considered as a first-line study.

Abbreviations

- CT, computed tomography
- INV, invasive
- IP, in progress
- IVP, intravenous pyelogram
- NUC, nuclear medicine
- US, ultrasound

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 evaluation of patients with renal trauma

POTENTIAL HARMS

- The relative radiation level is high for computed tomography (CT) of the abdomen and pelvis with contrast; and low for X-ray of the abdomen and pelvis and X-ray intravenous urography.
- CT exposes many young patients to ionizing radiation
- Diagnostic peritoneal lavage (DPL) should not be performed in children (because of the risk of injury to the bladder), in those who have had previous laparotomy (because intraabdominal adhesions may cause false negative results), or in those with retroperitoneal hematomas as a result of pelvic fractures (because of potential false positive results).
- *Ultrasound (US)*: Patients considered at high risk for a false negative study include those with hematuria, fractures of the lower ribs or lumbar spine, and pelvic fractures

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)

Sandler CM, Francis IR, Baumgarten DA, Bluth EI, Bush WH Jr, Casalino DD, Curry NS, Israel GM, Jafri SZ, Kawashima A, Papanicolaou N, Remer EM, Spring DB,

Fulgham P, Expert Panel on Urologic Imaging. Renal trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2007. 4 p. [24 references]

ADAPTATION

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

DATE RELEASED

1996 (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: Carl M. Sandler, MD; Isaac R. Francis, MD; Deborah A. Baumgarten, MD, MPH; 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; Erick M. Remer, 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 previously published version: Sandler CM, Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Jafri SZ, Kawashima A, Kronthal A, Older RA, Papanicolaou N, Ramchandani P, Rosenfield AT, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Renal trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 4 p. [24 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 March 25, 1999. The information was verified by the guideline developer on September 9, 1999. This summary was updated by ECRI on February 12, 2002. It was verified again by the guideline developer on March 25, 2002. This summary was updated by ECRI on March 8, 2006. This NGC summary was updated by ECRI Institute on December 4, 2007.

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