Complete Summary

GUIDELINE TITLE

Radiologic investigation of patients with renovascular hypertension.

BIBLIOGRAPHIC SOURCE(S)

Jafri SZ, Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Kawashima A, Kronthal A, Older RA, Papanicolaou N, Ramchandani P, Rosenfield AT, Sandler CM, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Radiologic investigation of patients with renovascular hypertension. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 7 p. [45 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: American College of Radiology (ACR), Expert Panel on Urologic Imaging. Radiologic investigation of patients with renovascular hypertension. Reston (VA): American College of Radiology (ACR); 2003. 9 p. (ACR appropriateness criteria).

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
METHODOLOGY - including Rating Scheme and Cost Analysis
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SCOPE

DISEASE/CONDITION(S)

Renovascular hypertension

GUIDELINE CATEGORY

Diagnosis
Evaluation

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Nephrology
Radiology
Urology

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 renovascular hypertension

TARGET POPULATION

Patients with known or suspected renovascular hypertension with or without diminished renal function

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Evaluation

1. Magnetic resonance angiography (MRA)
2. Computed tomography (CT)
3. Computed tomographic angiography (CTA)
4. Angiotensin-converting enzyme (ACE)-inhibitor renography
5. Ultrasound (US), duplex Doppler
6. Conventional angiography
7. X-ray
8. Renal vein renin assays
9. Hypertensive intravenous pyelogram (IVP)
10. Intravenous digital subtraction angiography (IVDSA)
11. Conventional angiography or intraarterial digital subtraction angiography (IADSA)

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 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 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: Renovascular Hypertension

Variant 1: High index of suspicion of renovascular hypertension and normal renal function

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRA, kidney	8	Reliability not affected by impaired

Radiologic Exam Procedure	Appropriateness Rating	Comments
		renal function.
CT, kidney	8	Similar to MRA in accuracy; requires intravenous contrast media.
ACE-inhibitor renography	6	Although the technique has not been standardized, it appears to have a relatively high sensitivity and specificity in patients with normal renal function.
US, kidney, duplex Doppler	6	Useful if there is a dedicated team of physicians and technologists who are skilled in the examination.
INV, kidney, angiography, IADSA	4	Considered the gold standard for diagnosing renal artery stenosis, but it is invasive. Probably not indicated as primary diagnostic method but must be performed prior to transluminal angioplasty. Reserved for confirmation and for angioplasty or stent placement.
Renal vein renin assays	3	Should not be used as a screening test but rather to confirm the clinical significance of a renal artery stenosis.
X-ray, kidney, IVP, hypertensive	1	Significantly less sensitive than other examinations.
INV, kidney, angiography, IVDSA	1	Difficult to perform on a reliable basis due to high number of inadequate studies.
Appropriateness Criteria Scale 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: High index of suspicion of renovascular hypertension and diminished renal function.

Radiologic Exam Procedure	Appropriateness Rating	Comments
US, kidney, duplex Doppler	8	Reliable if there is a dedicated team of physicians and technologists who are skilled in the examination

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRA, kidney	8	Useful in older patients with ASVD with diminished renal function who most likely have proximal renal artery stenosis
ACE-inhibitor renography	4	Although diminished renal function can affect the sensitivity and specificity of the exam, it is still reliable as a screening tool.
INV, kidney, angiography, intraarterial digital subtraction (IADSA)	4	Better than conventional angiography because it requires less contrast media, it is often used to guide angioplasty or stent placement
INV, kidney, angiography, intravenous digital subtraction IVDSA	4	Difficult to perform on a reliable basis and requires contrast media
Renal vein renin assays	3	Should not be used as a screening exam
X-ray, kidney, intravenous pyelogram, IVP, hypertensive	2	Significantly less sensitive than other exams and uses contrast media
CTA, kidney	1	Not indicated because of contrast load to kidneys
INV, kidney, angiography, conventional	1	Not indicated because of large contrast load to the kidneys
Appropriateness Criteria Scale 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: Low index of suspicion of renovascular hypertension ("essential" hypertension).

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-ray, kidney,	1	

Radiologic Exam Procedure	Appropriateness Rating	Comments
intravenous pyelogram, IVP, hypertensive		
US, kidney, duplex Doppler	1	
ACE-inhibitor renography	1	
MRA, kidney	1	
CTA, kidney	1	
INV, kidney, angiography, intravenous digital subtraction (IVDSA)	1	
Renal vein renin assays	1	
INV, kidney, angiography, intraarterial digital subtraction (IADSA)	1	
Appropriateness Criteria Scale 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.

Renovascular hypertension caused by a reduced perfusion pressure to one or both kidneys is usually due to renal artery stenosis and is, therefore, correctable on reversal of the stenosis. A critical problem in the diagnosis of renovascular hypertension is the selection of an appropriate end point against which to judge the accuracy of new tests. Calculations of the sensitivity, specificity, and accuracy of these examinations are normally based on a comparison with a standard such as conventional angiography. However, the definition of a significant renal artery stenosis has varied. Most investigators consider a 50% stenosis to be significant, yet perfusion pressure in a large artery is generally not reduced until stenosis exceeds 70%. Ultimately, the defining criterion for renovascular hypertension is a fall in blood pressure after intervention (angioplasty, intravascular stent placement, or surgery). Bilateral renal artery disease remains a problem in that it is difficult in such cases to quantify the effect on blood pressure of one side versus the other.

To improve the predictive value of diagnostic imaging examinations, a variety of clinical findings are associated with an increased likelihood of renovascular hypertension. These include an abdominal bruit, malignant or accelerated hypertension, significant (diastolic>110) hypertension in a young adult (<35 years), new onset after age 50, sudden development or worsening of hypertension, refractory hypertension, deterioration of renal function in response to angiotensin-converting enzyme (ACE) inhibitors, and generalized arteriosclerotic occlusive disease with hypertension.

The following is a discussion of each of the noninvasive diagnostic imaging examinations for renovascular hypertension.

Hypertensive Intravenous Pyelogram (IVP)

In 1972, authors reviewed the data from the cooperative study on renovascular hypertension and concluded that a hypertensive intravenous pyelogram (IVP) had 84% sensitivity in the detection of renal artery stenosis in all patients who presented with hypertension. Later, other authors performed a retrospective analysis at their institution and reanalyzed the data from the cooperative study of renovascular hypertension. They found the IVP not to be useful, with a sensitivity of 60% for the detection of surgically correctable disease. In a retrospective review of rapid sequence IVP of 241 patients with features suggestive of renovascular disease, one study demonstrated that a normal sequence IVP excluded renovascular disease with 93% probability but failed to diagnose 20% of cases. Currently, most clinicians and diagnostic radiologists believe that the hypertensive IVP is not useful as a screening test and has no role in the evaluation of patients with suspected renovascular hypertension.

Intravenous Digital Subtraction Angiography

Intravenous digital subtraction angiography (IVDSA) was developed in the late 1970s, and many reports arrived in the early 1980s describing the potential utility of this examination for the evaluation of patients with renovascular hypertension. In spite of early optimism for the procedure, many investigators have been unable to reproduce the impressive initial results. Apparently, a relatively high percentage of patients have technically inadequate studies, and the contrast load is often substantially higher than for arteriography, making the procedure hazardous in patients with diabetes or renal insufficiency. The resolution of the procedure does not compare with arterial studies, and fibromuscular lesions of branch arteries may be missed. IVDSA does not appear to be indicated as a screening examination for renovascular hypertension.

Selective Renal Vein Renin Assays

Although selective renal vein assays are not used as the sole screening test in patients with suspected renovascular disease, this examination is often used in various medical centers to confirm the clinical significance of a renal artery stenosis. Various parameters have been described, including renal vein/inferior vena cava (IVC) ratios, right renal vein/left renal vein ratios, etc. The examination has several major limitations, including variable sampling techniques, a 2- to 3-day delay in reporting results, and limited sensitivities (65 to 74%). Specificity of this examination, however, can be quite high (up to 100%). Most clinicians use

this technique to confirm the clinical significance of a renal artery stenosis. Peripheral renin concentration in the normal range may be used as an indicator of no benefit from intervention. Therefore, this examination should probably be used not as a screening test but rather as a confirmatory examination when there is a clinical question of whether the renal artery stenosis is in fact causing hypertension.

Duplex Doppler Sonography

Duplex Doppler sonography is an attractive technique as a noninvasive screening test in that it is relatively inexpensive, does not require contrast medium, and can be used in patients with any level of renal function. As with many of the noninvasive imaging examinations, there are numerous parameters and abnormal criteria indicating possible renovascular disease. The most frequently quoted parameters are a peak systolic velocity in the renal artery exceeding 180 or 200 cm/s and a renal artery/aortic velocity ratio exceeding 3.5. Using these parameters, early investigators have quoted sensitivities from 85 to 90%. Specificities were also quite high at 95%. However, many investigators have had trouble duplicating these results and have reported extremely poor sensitivities, as low as 0%. (Variable results are largely due to technically inadequate studies and using 100 cm/s as a threshold for normal velocity, thereby producing a high number of false positive studies.) A major problem in many of these studies is that approximately 10 to 20% of patients may have technically inadequate studies secondary to obesity or overlying bowel gas. In addition, examination times have varied from 10 to 15 minutes to up to 1.5 hours. The variability in examination time has no doubt contributed to the variability in sensitivity rates reported in the literature.

Some reports have advocated segmental renal artery waveform analysis using measurements such as acceleration time and acceleration index, as well as "parva and tarda" waveform appearances. Using upper, middle, and lower pole segmental artery waveform analysis in the kidneys, these investigators have found the technique to be approximately 85 to 90% sensitive. An increase in acceleration time (normal <70 milliseconds) and loss of the early systolic peak (ESP) appear to be the most useful parameters. Administration of ultrasound contrast agent improves the quality of renal artery images, reduces mean examination time, and improves visualization of the entire length of the main renal arteries. Although this technique has not been duplicated yet in the literature, many academic centers believe it may hold significant promise in the evaluation of patients with renovascular hypertension. Because of the difficulty and time involved in the examination, duplex Doppler sonography should be used in medical centers where the technique has proven to be reliable and where dedicated technologists and physicians are skilled in the examinations. Several recent comparative studies have demonstrated that Doppler sonography with or without administration of captopril or ultrasound contrast is more sensitive and specific than ACE-inhibitor (ACEI) scintigraphy. Doppler sonography may be of use in predicting the outcomes for renal artery interventions. When resistive index values exceed 80, the results in terms of reducing hypertension or improving renal function are usually poor.

ACE-Inhibitor Renography/Scintigraphy

Renal scanning with radionuclide agents is noninvasive and safe, even in patients with renal insufficiency. In addition, many reports have been very positive, showing a high degree of sensitivity and ability to accurately identify patients who will benefit from surgical or angioplasty intervention. However, the literature is nonuniform in techniques, radionuclide agents, and interpretation parameters. For example, iodine-131 Hippuran, DTPA, and technetium-99m MAG3 have all been advocated for use in captopril or other ACE-inhibitor renograms. MAG3 and Hippuran are primarily excreted via tubular secretion, whereas DTPA is totally eliminated by glomerular filtration. When using technetium-99m MAG3, a renogram curve showing a prolonged time to peak activity and delayed washout suggests renovascular hypertension. The extraction fraction of DTPA is approximately 20% and for MAG3 it is 40% to 50%. MAG3 is preferred over DTPA in patients with suspected obstruction and impaired renal function.

Because the glomerular filtration rate (GFR) in kidneys with a partial vascular obstruction is significantly reduced by an ACE inhibitor, the utility of ACE-inhibitor-enhanced GFR renography (DTPA) is quite dramatic. Apparently, renal tubular secretion is also dramatically affected by the addition of an ACE inhibitor, and iodine-131 Hippuran and technetium-99m MAG3 are therefore also sensitive in the detection of renal artery stenosis. Because technetium-99m MAG3 uses technetium-99m, it provides superior images and counting accuracy compared to iodine-131 Hippuran. Currently iodine-131 orthoiodohippurate is not recommended for routine use. There appears to be a developing consensus on which method and agent to use.

A review of the current literature regarding all methods of captopril renography revealed sensitivities generally in the range of 80 to 100%. Several studies have pointed out that captopril renography is highly specific in identifying patients who will benefit from surgical or angioplasty intervention. This seems to be more evident with the tubular secretion agents (iodine-131 Hippuran and technetium-99m MAG3). Normal findings on ACE inhibition renography indicate a low probability of renovascular hypertension. Abnormal baseline findings that improve after ACE inhibition also indicate a low probability of renovascular hypertension. ACE inhibition renography is less accurate in azotemic patients. The ability to identify the patient who will benefit from surgery or angioplasty is considered highly valuable. The relatively high sensitivity and specificity of this examination have enabled it to be a primary screening modality for renovascular hypertension, especially in patients with normal or near-normal renal function. When ACEI renography is performed in patients with ischemic nephropathy or a small, poorly functioning kidney, as many as 50% of the studies may have an indeterminate probability scan. Moreover, asymmetry of blood flow in patients, even those, with patent renal arteries as demonstrated by 133 xenon washout techniques, may result in false positive results on renal scintigraphy. It is not a test for detecting the presence or absence of renal artery stenosis.

Magnetic Resonance Angiography

Magnetic resonance angiography (MRA) has changed the workup of renal artery stenosis. The reliability of MRA is not affected by impaired renal function or the presence of bilateral renovascular disease. It is unnecessary to hydrate the patients or to stop diuretics before the examination. Currently three-dimensional contrast-enhanced MRA with an intravenous injection of gadolinium-based

contrast agent forms the backbone of MR examination of renal arteries. MRA is noninvasive, and the gadolinium chelate contrast agents used are not nephrotoxic when administered in the recommended doses. Several investigators report using angiography as the standard of reference, with sensitivity and specificities ranging from 88 to 100% and 71 to 100% respectively. With the use of high-spatial-resolution small-field-of-view technique it is now possible to evaluate not only the main renal arteries but also the accessory renal arteries and distal stenosis. Most MR techniques solely rely on the morphologic assessment of the vasculature. To assess the hemodynamic consequences of a particular arterial lesion, additional functional tests are sometimes required. Although still investigational, cine phase contrast MR flow quantification techniques in combination with 3D-gadolinium MR angiography appear to be feasible for detecting and determining the degree of renal artery stenosis. A combination of cine phase-contrast MR renal flow and parenchymal volume measurements enables identification of patients who may benefit from percutaneous transluminal angioplasty and stent placement.

Computed Tomographic Angiography (CTA)

Computed tomographic angiography (CTA) involves the process of rapidly acquiring volumetric images by moving the beam continuously in a helical manner across a region of interest during a single bolus infusion of intravenous contrast, usually 130 to 150 mL. This volume of contrast raises the risk of nephrotoxicity in patients with preexistent renal failure. A prospective randomized study comparing intraarterial digital subtraction angiography (IADSA) to CTA demonstrated no increased risk for contrast nephropathy despite a greater dose of contrast media.

Sophisticated methods of image processing allow three-dimensional displays of the aorta and renal vasculature that are remarkably clear, and the main value of CTA currently is in evaluating renal donors preoperatively.

Two studies comparing CTA with digital renal arteriography have reported the sensitivity of CTA for detecting significant stenoses (greater than 50% narrowing) to be 88 to 96% and the, specificity 77 to 98%, and in one study the accuracy was 89%. In diagnosing narrowing of only the main renal arteries, one study found the sensitivity and specificity to be 100% and 98% respectively. Normal results from CTA virtually rule out renal artery stenosis. Both maximum-intensity projection (MIP) and volume-rendering techniques are useful and complementary in CT evaluation of renal artery stenosis. Secondary signs include poststenotic dilatation, renal parenchymal changes of atrophy, and decreased cortical enhancement. A threshold of 800 mm^2 for cortical area and 8 mm for mean cortical thickness seen on computed tomography can be a useful morphologic marker of atherosclerotic renal disease. CTA can be used to assess patency of renal stent grafts. Like MRA, CTA is more accurate in diagnosing these proximal lesions. However, improvements in both MRA and CTA techniques in the near future are likely to render catheter angiography unnecessary in the diagnosis of renal arterial disease.

Summary

Diagnostic imaging for hypertension depends on the index of suspicion for renovascular disease and on the patient's renal function. If clinical findings strongly suggest the possibility of renovascular disease, contrast-enhanced MRA

or CTA should be performed. Duplex Doppler sonography or captopril scintigraphy could also be used if MRA is not desired or is contraindicated. CT angiography may be helpful in a select group of patients who are likely to have proximal renal artery stenosis. Conventional angiography and IADSA should be reserved for confirmation and therapeutic reasons such as angioplasty and stent placement, especially with the recent advances in the MR and CT techniques and their successful results.

Three variants in this guideline are based on the index of suspicion for renovascular disease and on the patient's renal function. The first variant is for those patients with a high index of suspicion for renovascular disease who have normal renal function. In these patients, contrast-enhanced MRA is the most accurate means to evaluate for renovascular disease. Captopril renography is also very adequate in these patients, if MRA is not desired or is contraindicated. Duplex Doppler sonography also can be used in these patients if a dedicated team of technologists and radiologists is available and the technique has proven to be reliable in that medical center.

The second variant includes patients with a high index of suspicion for renovascular disease and diminished renal function. In these patients, gadolinium-enhanced contrast MRA or duplex Doppler sonography are the preferred screening examinations, especially in a medical center where the technique has proven to be reliable and where dedicated technologists and physicians are skilled in the examination and can perform it with a high degree of accuracy. Captopril renography is not a reliable test in patients with poor renal function. CT angiography may also be contraindicated secondary to renal insufficiency.

Finally, a third variant includes patients with hypertension and a low index of suspicion for renovascular disease. These patients most likely have "essential" hypertension that is usually easily controlled with medication. There is no need for diagnostic imaging in these patients.

Abbreviations

- ACE-inhibitor, angiotensin-converting enzyme inhibitor
- ASVD, atherosclerotic vascular disease
- CT, computed tomography
- CTA, computed tomographic angiography
- IADSA, intraarterial digital subtraction
- INV, invasive
- IVP, intravenous pyelogram
- IVDSA, intravenous digital subtraction
- MRA, magnetic resonance angiography
- US, ultrasound

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 known or suspected renovascular hypertension

POTENTIAL HARMS

- Intravenous digital subtraction angiography (IVDSA) is hazardous in patients with diabetes or renal insufficiency.
- A single bolus infusion of intravenous contrast, usually 130 to 150 mL, raises the risk of nephrotoxicity in patients with preexistent renal failure.

CONTRAINDICATIONS

CONTRAINDICATIONS

Computed tomographic angiography may be contraindicated secondary to renal insufficiency.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Task Force 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 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 coexistent 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 United States 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
Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Jafri SZ, Choyke PL, Bluth EI, Bush WH Jr, Casalino DD, Francis IR, Kawashima A, Kronthal A, Older RA, Papanicolaou N, Ramchandani P, Rosenfield AT, Sandler CM, Segal AJ, Tempany C, Resnick MI, Expert Panel on Urologic Imaging. Radiologic investigation of patients with renovascular hypertension. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 7 p. [45 references]

ADAPTATION

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

DATE RELEASED

1995 (revised 2005)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

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: S. Zafar H. Jafri, MD (Review Author); Peter L. Choyke, MD (Panel Chair); Edward I. Bluth, MD; William H. Bush, Jr, MD; David D. Casalino, MD; Isaac R. Francis, MD; Akira Kawashima, MD, PhD; Alan Kronthal, MD; Robert A. Older, MD; Nicholas Papanicolaou, MD; Parvati Ramchandani, MD; Arthur T. Rosenfield, MD; Carl M. Sandler, MD; Arthur J. Segal, MD; Clare Tempany, MD; Martin I. Resnick, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

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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

This NGC summary was completed by ECRI on November 15, 2004. The information was verified by the guideline developer on December 21, 2004. This NGC summary was updated by ECRI on January 5, 2006. The updated information was verified by the guideline developer on January 19, 2006.

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