Revised 2013 (Resolution 14)*

ACR–AIUM–SPR–SRU PRACTICE PARAMETER FOR THE PERFORMANCE OF NATIVE RENAL ARTERY DUPLEX SONOGRAPHY

PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care[1]. For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the practice parameters, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the practice parameters when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of the practice parameters. However, a practitioner who employs an approach substantially different from these practice parameters is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to these practice parameters will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these practice parameters is to assist practitioners in achieving this objective.

[1] Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing, ___ N.W.2d ___ (Iowa 2013) Iowa Supreme Court refuses to find that the *ACR Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures* (Revised 2008) sets a national standard for who may perform fluoroscopic procedures in light of the standard's stated purpose that ACR standards are educational tools and not intended to establish a legal standard of care. See also, Stanley v. McCarver, 63 P.3d 1076 (Ariz. App. 2003) where in a concurring opinion the Court stated that "published standards or guidelines of specialty medical organizations are useful in determining the duty owed or the standard of care applicable in a given situation" even though ACR standards themselves do not establish the standard of care.

I. INTRODUCTION

The clinical aspects contained in specific sections of this practice parameter (Introduction, Indications, Specifications of the Examination, and Equipment Specifications) were revised collaboratively by the American College of Radiology (ACR), the American Institute of Ultrasound in Medicine (AIUM), the Society for Pediatric Radiology (SPR), and the Society of Radiologists in Ultrasound (SRU). Recommendations for physician requirements, written request for the examination, procedure documentation, and quality control vary among the organizations and are addressed by each separately.

Ultrasound using grayscale imaging, Doppler spectral analysis, and color Doppler imaging (CDI) is a proven and useful procedure for evaluating the renovascular system. Occasionally, an additional and/or specialized examination may be necessary. While it is not possible to detect every abnormality, adherence to the following practice parameters will maximize the probability of detecting most renovascular abnormalities.

II. INDICATIONS/CONTRAINDICATIONS

Indications for renal artery duplex include, but are not limited to:

1. Evaluation of patients with hypertension, particularly when there is a moderate to high suspicion of renovascular hypertension (for example, uncontrolled hypertension despite optimal therapy, hypertension with progressive decline in renal function, progressive decline in renal function associated with ACE inhibition therapy, abrupt onset of hypertension) [1,2].
2. Follow-up of patients with known renovascular disease who have undergone renal artery stents placement or other renal artery intervention or have a known unilateral stenosis with concern for a stenosis in the contralateral kidney.
3. Evaluation of an abdominal or flank bruit.
4. Evaluation of a suspected vascular abnormality such as an aneurysm, pseudoaneurysm, arteriovenous malformation, or arteriovenous fistula.
5. Evaluation of renal insufficiency in a patient at risk for renovascular disease.
6. Evaluation of renal artery blood flow in patients with known aortic dissection, trauma, or other abnormalities that may compromise blood flow to the kidneys.
7. Evaluation of discrepant renal size.
8. Concern for aortic or renal artery orifice thrombus in infants who have or have had an aortic catheter, such as an umbilical artery catheter.

There are no absolute contraindications to performing this examination.

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

Each organization addresses this requirement individually. ACR language is as follows:

See the ACR–SPR–SRU Practice Parameter for Performing and Interpreting Diagnostic Ultrasound Examinations.

IV. WRITTEN REQUEST FOR THE EXAMINATION

Each organization addresses this requirement individually. ACR language is as follows:

The written or electronic request for renal artery duplex sonography should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). Additional information regarding the specific reason for the examination or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient's clinical problem or question and consistent with the state scope of practice requirements. (ACR Resolution 35, adopted in 2006)

V. SPECIFICATIONS OF THE EXAMINATION

The study is generally performed for both kidneys. If not, the report should state the reason for a unilateral study (e.g., evaluation of renal stent, known solitary kidney).

The study consists of grayscale imaging of the kidneys with spectral and color Doppler of the extrarenal and intrarenal vessels.

A. Grayscale Imaging

The longest renal length should be measured and reported. In patients who have not had recent cross-sectional imaging of the kidneys, a complete renal ultrasound examination may be considered. See the ACR–AIUM–SPR–SRU Practice Parameter for the Performance of an Ultrasound Examination of the Abdomen and/or Retroperitoneum.

B. Spectral and Color Doppler Evaluation

Analysis of main renal artery and intrarenal arterial waveforms should be used to evaluate for renal artery stenosis.

Careful attention to technique is important to ensure accurate examination results, including selecting a transducer that is appropriate for the patient's body habitus, optimizing color Doppler parameters, using an appropriate sample volume, optimizing the velocity scale for the size of the waveform to avoid aliasing (this may require adjusting the scale, baseline, or frequency, or selecting a lower frequency transducer), and using the lowest feasible angle of insonation. Angle correction is essential for determining blood-flow velocity. The angle between the direction of flowing blood and the applied Doppler ultrasound signal should not exceed 60 degrees.

1. Main renal artery evaluation

   The entire main renal artery should be scanned along its long axis using optimized color Doppler parameters. Occasionally, power Doppler or grayscale imaging may be necessary to localize a portion of the artery. Inability to visualize the entire or part (especially the origin) of the main renal artery should be reported.

   Spectral Doppler should be performed along the vessel's length from the origin to the hilum at the lowest feasible angle of insonation.

   The greatest peak systolic velocities should be recorded at the origin/proximal portion, at mid aspect, and near the hilum [3-18]. A peak systolic velocity should also be recorded at any site of color aliasing or suspected stenosis. If there is a significant stenosis, a Doppler waveform should be recorded within the stenosis and distal to the stenosis.

An effort should also be made to search for accessory renal arteries [19]. When visualized, peak systolic velocities should be recorded as described above.

An appropriate angle-corrected spectral waveform from the abdominal aorta at the level of the renal arteries should be recorded. Aortic peak systolic velocity is used to calculate the ratio of the peak systolic velocity in the renal artery to the aorta (RAR).

Renal artery stent evaluation should include recording a peak systolic velocity in the proximal renal artery (if possible), within the stent, and distal to the stent (if possible) [20].

In infants who have developed aortic thrombus after catheterization, the relationship of the clot to the renal arterial orifices and the flow around the thrombus should be documented. If the thrombus is located near a renal artery orifice, renal arterial and intraparenchymal waveforms should be obtained to assess renal perfusion.

2. Intrarenal evaluation

Spectral waveforms should be recorded from segmental arteries in the upper and lower poles and the interpolar region (mid-portion) of each kidney. It is important to use a fast sweep speed and optimize the velocity scale to ensure accurate results. If acceleration index measurements are used in assessment, angle correction is needed; the angle of insonation should be as low as possible, usually 20 degrees or less.

Intrarenal analysis consists of quantitative and/or qualitative evaluation of the Doppler waveforms. Quantitative evaluation may include acceleration times, acceleration indices [21,22], or resistive indices [23-25]. For qualitative analysis, the morphology of the waveform should be assessed for a normal systolic upstroke or tardus parvus changes [21,22].

VI. DOCUMENTATION

Each organization addresses this requirement individually. ACR language is as follows:

Adequate documentation is essential for high-quality patient care. There should be a permanent record of the ultrasound examination and its interpretation. Comparison with prior relevant imaging studies may prove helpful. Images of all appropriate areas, both normal and abnormal, should be recorded. Variations from normal size should generally be accompanied by measurements. Images should include the patient identification, facility identification, examination date, and image orientation. An official interpretation (final report) of the ultrasound examination should be included in the patient's medical record. Retention of the ultrasound examination images should be consistent both with clinical need and with relevant legal and local health care facility requirements.

Reporting and communication efforts should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings.

VII. EQUIPMENT SPECIFICATIONS

Duplex and color Doppler ultrasound of the renal arteries should be performed in real time using a scanner with color and spectral Doppler capabilities. Transducer selection should be based on body habitus. For adults, mean frequencies between 2 and 5 MHz are most commonly used. In neonates, transducer frequencies of 7 to 15 MHz are typically used.

VIII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

Each organization addresses this requirement individually. ACR language is as follows:

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR website (http://www.acr.org/guidelines).

Equipment performance monitoring should be in accordance with the ACR Technical Standard for Diagnostic Medical Physics Performance Monitoring of Real Time Ultrasound Equipment.

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