



VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Renal Artery Duplex Imaging

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VASCULAR PROFESSIONAL PERFORMANCE GUIDELINE

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PURPOSE

Duplex imaging of the renal arteries is performed to determine the absence or presence, type, location, extent and severity of stenosis, aneurysm, or other diseases of the renal arteries.

APPROPRIATE INDICATIONS

Common indications for renal artery duplex exam include, but are not limited to:

- Renal artery disease or renal parenchymal disease
- Presence of epigastric or flank bruit in a hypertensive patient
- New onset of hypertension or hypertension refractory to medical management
- Screening for renal artery stenosis prior to medical management with ACE inhibitors
- Presence of elevated creatinine or BUN Monitoring of known renal artery stenosis
- Evaluation for renal size discrepancy between right and left kidneys, defined as a length difference greater than >2 cm
- Suspected renal vein occlusion
- F/U renal artery bypass graft
- Renal artery embolus
- Fibromuscular Dysplasia (known, suspected or family history)
- Suspected renal artery aneurysm
- F/U angioplasty and/or stent
- Suspected arteriovenous fistula
- Presence of a thrill or bruit following renal biopsy
- Evaluation of renal transplant dysfunction
- Presence of bruit in region of renal transplant

CONTRAINDICATIONS AND LIMITATIONS

Contraindications and limitations may include the following:

- Fresh surgical incisions/drains
- Ostomy bags
- Rapid breathing or on respirator
- Inability to hold breath
- Bowel gas
- Obesity
- Inability to change position
- Patient cooperation

PATIENT PREPARATION

- The patient should be NPO (nothing by mouth) for at least 8 hours prior to the examination, when possible.
- Examination should be scheduled early in the day to minimize bowel gas interference.
- If medications cannot be withheld, the patient may take required

morning medications with a small sip of water.

- The patient should avoid chewing gum and smoking on the morning of the examination, as this may increase swallowed air and bowel gas.

PATIENT COMMUNICATION

The sonographer should:

- Introduce themselves, explain the purpose for the examination, and provide an estimated duration.
- Verify the patient's identity using two identifiers (e.g. name and date of birth) or according to facility policy.
- Explain the procedure to the patient in a manner appropriate to the patient's age, cognitive level, and clinical condition, ensuring understanding of the examination and its components.
- Instruct the patient on breath-holding techniques that may be required during the examination, including demonstration when necessary (e.g. suspended respiration or inspiration hold without exhalation).
- Address patient questions and concerns related to the examination.
- Refer specific diagnostic, treatment or prognosis questions to the patient's physician or appropriate provider.

PATIENT ASSESSMENT

A patient assessment must be performed before the examination. This includes an assessment of the patient's ability to tolerate the procedure and an evaluation of any contraindications to the procedure. The sonographer or examiner should obtain a complete, pertinent history by interview of the patient or their representative and reviewing the patient's medical record when available.

A pertinent history includes:

- Current medical status, especially regarding known arterial disease or poorly controlled hypertension.
- Current kidney function and/or other renal abnormality
- Laboratory values, particularly BUN and serum Creatinine (when available), according to individual laboratory protocols
- Signs or symptoms of peripheral vascular disease
- History of fibromuscular dysplasia
- History of cardiac disease
- Current medications or therapies
- Results of prior vascular studies and other imaging modalities when available

PATIENT POSITIONING

The exam should be initiated with the patient in a supine position to evaluate the aorta, renal artery origins, and proximal to mid renal arteries. The distal renal

arteries, renal veins, intrarenal flow and kidney measurements are typically best visualized with the patient lying in a lateral decubitus position. Alternative patient positioning should be utilized as needed to optimize visualization and ensure complete data acquisition.

INSTRUMENTATION

Utilize appropriate duplex instrumentation with the appropriate frequencies for the vessels being examined:

- Typically, a 2-6 MHz curvilinear or phased array transducer
 - Utilize multiple transducers, if available, to visualize anteriorly and through the intercostal rib spaces
- Display of two-dimensional structures and motion in real-time
 - Doppler ultrasonic signal documentation
 - Spectral analysis with color and/or power Doppler imaging
- Digital storage of ultrasound images is required

EXAM PROTOCOL

The technologist/sonographer should follow a standardized imaging protocol. A complete evaluation includes grayscale imaging, spectral Doppler analysis, and color Doppler imaging of all accessible portions of the renal arteries. Power Doppler may be used to determine low flow state or vessel occlusion.

Bilateral evaluations are essential for a complete evaluation; however, examinations may be performed unilaterally based on clinical indication and laboratory-specific protocols.

Throughout each examination, the sonographer or technologist should:

- Assess and monitor the patient's physical and mental status, modifying the examination as appropriate to the patient's condition.
- Observe sonographic characteristics of normal and abnormal tissues, structures, and blood flow, adjusting technique as needed to optimize image quality.
- Accurately annotate all grayscale, color Doppler, and spectral Doppler images.
- Analyze sonographic findings in real time to ensure that sufficient data is obtained to support physician interpretation and diagnosis. Document any study limitations.

COMPLETE RENAL ARTERY DUPLEX EXAM

A complete renal artery duplex examination includes evaluation of the abdominal aorta, bilateral main renal arteries, renal veins, intrarenal (parenchymal/hilar) arteries, and bilateral kidneys. Accessory (duplicate) renal arteries should be evaluated when present.

Grayscale imaging should be performed in longitudinal and transverse planes, with optimization of gain to clearly demonstrate vessel walls, plaque, thrombus, renal parenchyma, and other abnormalities. Renal size and parenchymal echogenicity should be assessed and documented.

Color Doppler should be used to evaluate flow patterns and identify areas of abnormal flow or suspected stenosis. Color scale and gain should be adjusted to ensure vessel fill

without artifact. Reduce color gain if “color bleed” is present. Power Doppler may be utilized to confirm areas of low flow or vessel occlusion.

Grayscale Imaging Requirements:

- Aorta at or slightly cephalad to the origins of the renal arteries.
- Maximum diameter of the abdominal aorta should be obtained in longitudinal and transverse planes
- Longitudinal length measurements of the kidneys
 - Obtain three length measurements per kidney to increase accuracy
 - Cysts, masses and hydronephrosis should be documented
- Renal Cortex thickness measurements should be obtained in the transverse plane if required by facility protocol
- Renal arteries (if adequately seen in grayscale)
- Renal veins

Color Doppler Imaging Requirements:

- Aorta at or slightly cephalad to the origins of the renal arteries.
- Renal arteries
- Renal veins
- Segmental and parenchymal arteries within the kidney

Velocity measurements should be obtained from a longitudinal plane with the Doppler angle aligned parallel to the direction of blood flow and vessel walls. The Doppler angle should not exceed 60°. A consistent angle (typically 60°) should be used whenever possible for reproducibility; however smaller angles may be used when required by patient anatomy.

Color Doppler should be used to identify areas of increased velocity or flow disturbance. The spectral Doppler should then be systematically advanced (“walk”) throughout the vessel to evaluate for velocity changes, identify areas of stenosis, and obtain peak systolic velocities at the point of highest velocity. Peak velocities should be confirmed to ensure reproducibility. Post-stenotic turbulence should be documented when present.

Spectral Doppler Waveforms Requirements:

- Aorta at or slightly cephalad to the origins of the renal arteries.
- Origin, proximal, mid, and distal portions of the main renal arteries
 - Accessory renal arteries (when present)
 - Renal artery stents (when present)
- Parenchymal (upper, mid, and lower poles – Doppler of 0°)
 - Used to obtain the resistive index (RI)
- Renal veins for patency (does not require velocity measurements)
- Inferior vena cava (does not require velocity measurements)

RENAL VEINS

A more detailed evaluation of the renal veins may be necessary when there is clinical concern for renal vein thrombosis or stenosis, or when abnormal findings are present during a routine renal duplex examination. Grayscale, color Doppler, and spectral

Doppler is used to assess for the presence of stenosis and/or intraluminal thrombus. If stenosis is suspected, velocity measurements are obtained proximal to, within, and distal to the affected segment. The inferior vena cava may be included in the evaluation when abnormalities are present.

RENAL ARTERY STENTS

Renal artery stents should be evaluated using a combination of grayscale, color Doppler, and spectral Doppler imaging. Grayscale imaging is used to directly visualize the stent and to assess positioning within the renal artery. Color Doppler should be applied throughout the stented segment to assess for flow disturbances suggestive of luminal narrowing, restenosis, obstruction, or stent malposition. Doppler angle should be aligned parallel to the direction of blood flow and vessel walls and should not exceed 60°. A consistent angle (typically 60°) should be used whenever possible for reproducibility; however smaller angles may be used when required by patient anatomy. Peak velocities should be confirmed to ensure reproducibility.

Grayscale/Color Doppler Imaging Requirements:

- Obtain images of the stent, including proximal and distal ends.

Spectral Doppler Imaging Requirements:

- Native artery at the proximal end of the stent, proximal stent, mid stent, distal stent, and native artery at the distal end of the stent.

Interpretation Considerations for Renal Stent:

- The diameter of the stented segment of the renal artery may be slightly larger than the native renal artery. This diameter change can result in increased peak systolic velocity as the blood moves from a larger diameter to the smaller diameter of the non-stented artery.
- The stent should be evaluated for correct placement within the renal artery. If there is a distinct flow disturbance within the aorta at the level of the renal artery, this may be an indication that the stent is protruding into the lumen of the aorta.

REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review data acquired during the evaluation to ensure that a complete and comprehensive evaluation has been performed and documented.
- Explain and document any exceptions to the evaluation protocol (i.e., study limitations, omissions or revisions).
- Record all technical findings required to complete the final diagnosis in the patients' medical record
- Document exam date, clinical indication(s), technologist performing the evaluation and exam summary in the patients' medical record.

- Review previous exam documentation and compare the current exam to document and compare any change.

PRESENTATION OF EXAM FINDINGS

The sonographer or examiner should:

- Provide preliminary results when necessary as determined by laboratory-specific guidelines.
- Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician. Interpretation must be available within two business days.
- The sonographer's and interpreting physician's names must appear on the final report. The finalized/signed report should be available within four business days.
- Alert the vascular laboratory medical director or appropriate healthcare provider when immediate medical attention is indicated based on departmental guidelines and procedures.

EXAM TIME RECOMMENDATIONS

High quality, accurate results are fundamental elements of the renal artery duplex examination. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy.

- Indirect exam components include:
 - Pre-exam activities: obtaining previous exam data, initiating exam worksheet and paperwork, equipment and exam room preparation, patient assessment and positioning, and patient communication
 - Post-exam activities: exam room cleanup, compiling and processing exam data for preliminary and/or formal interpretation, and exam billing activities.
- Direct exam components include:
 - Equipment optimization and the actual hands-on, examination process
- While study times may vary depending on testing protocols, patient condition, and clinical complexity of the evaluation being performed, these are the times necessary to provide a quality diagnostic evaluation. Listed are the recommended examination times for performing each CPT related to this guideline, which were derived from the direct time inputs from the Resource Based Relative Value Scale (RBRVS).
 - 93975 92 minutes
 - 93976 53 minutes

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