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VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Renal Artery Duplex Imaging

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Renal Artery Duplex Imaging

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 disease of the renal arteries.

COMMON INDICATIONS

Some of the common indications for performance of renal arterial duplex imaging include:

- Evaluation of the native renal arteries and kidneys for evidence of 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
- Suspected renal vein occlusion
- F/U renal artery bypass graft
- Renal artery embolus
- 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 over renal transplant

CONTRAINDICATIONS AND LIMITATIONS

Limitations may include: fresh surgical incisions, drains, rapid breathing, bowel gas, patient positioning and cooperation.

PATIENT PREPARATION

The patient should have no food by mouth after midnight to minimize bowel gas and studies should be performed early in the day. A bowel prep is usually not necessary. The patient should take morning medications with sips of water only and abstain from dairy products or citrus juices as they may cause abdominal gas. The patient should not chew gum or smoke the morning of the exam as this may increase swallowing of air. Consideration should be given to patients who need to eat in order to take medications, i.e., those with diabetes.

GUIDELINE 1: PATIENT COMMUNICATIONS AND POSITIONING

The technologist/sonographer/examiner should:

- 1.1 Explain why the Renal Artery Duplex Examination is being performed and indicate how long it will take.
- 1.2 Explain the procedure to the patient, taking care to ensure that the patient understands the necessity for each aspect of the evaluation.
- 1.3 Respond to questions and concerns about any aspect of the examination.
- 1.4 Educate patients about risk factors for and symptoms of renal artery disease.
- 1.5 Inform patients about necessary life style changes due to vascular disease.
- 1.6 Refer specific questions about diagnosis, treatment or prognosis to the patient's physician
- 1.7 Initiate the examination with the patient lying in a supine position for examination of the aorta, renal ostium and proximal-to-med renal artery. The distal renal artery, renal vein, intrarenal flow and kidney measurements may be performed with the patient lying in a lateral decubitus position.

GUIDELINE 2: PATIENT ASSESSMENT

Patient assessment must be performed before initiating Renal Artery Duplex Evaluation. This includes assessment of the patient's ability to tolerate the procedure and an evaluation of any contra-indications to the procedure.

The technologist/sonographer/examiner should:

- 2.1 Obtain a complete, pertinent history by interviewing the patient or patient's representative and reviewing the patient's medical record. A pertinent history includes:
 - a. Current medical status, especially regarding known arterial disease or poorly controlled hypertension
 - b. Current kidney function and/or other renal abnormality
 - c. Presence of signs or symptoms of peripheral vascular disease: claudication, rest pain, ulceration, gangrene, ischemia, hair loss, coolness, pallor, dependent rubor, cervical, abdominal or lower extremity bruit
 - d. Relevant risk factors for peripheral vascular disease: diabetes; hypertension; cerebrovascular disease; coronary artery disease; family history of cerebrovascular, coronary artery, or peripheral vascular disease; family history of diabetes or hypertension; age; smoking, obesity
 - e. History of other related disorders such as fibromuscular dysplasia
 - f. Laboratory values, particularly BUN and serum creatinine when available
 - g. Current medications or therapies
 - h. Results of other vascular studies
- 2.2 Complete a limited or focused physical exam, including palpation of femoral pulses, auscultation for abdominal bruit, notation of surgical or traumatic scars, incisions, etc.

GUIDELINE 3: EXAMINATION GUIDELINES

Diagnostic criteria must include application of published criteria or internally generated criteria. All diagnostic criteria must be internally validated. In general, gray scale and color flow imaging are used to identify and follow the selected vessel segments and to note the presence or absence of any disease process within the vessel lumen. Spectral Doppler evaluation is used to quantify disease severity and should include assessment for presence or absence of flow and, when flow is present, evaluation of peak systolic velocity, end diastolic velocity, and waveform analysis [e.g., systolic upstroke/acceleration, pulsatility or resistive indices, spectral broadening, turbulence and flow

direction]. At a minimum, spectral analysis should be obtained throughout all vessel segments and proximal, within and distal to any region of disordered flow. All spectral velocity information is obtained with a documented Doppler insonation angle of <60 degrees.

Based on the published data, the following cautions are included:

- It is important to use the same range of Doppler angles in the proximal, mid and distal renal artery
 - Caution should be exercised when comparing estimated velocities of the same location from two different angles of insonation.
- 3.1. The patient's clinical status is assessed and monitored during the examination, with modifications made to the procedure plan according to changes in status during the procedure. Also, findings are analyzed throughout the course of the examination to ensure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.
 - 3.2. Appropriate duplex instrumentation is used (with Doppler frequencies typically in the range of 2.0–5.0 MHz), which includes real time display of both two-dimensional structure and motion with or without color flow imaging and Doppler ultrasonic signal documentation with:
 - a. spectral analysis
 - b. hardcopy capabilities (It is recommended that both video and static images are acquired.)
 - 3.3. This exam is generally performed with a minimum preparation of fasting after midnight the evening prior to the examination in order to minimize bowel gas. If the physician feels that this is an acute problem, the patient may be studied without fasting. Abdominal exams generally require various acoustic windows and patient positions in order to optimize the data. Positions vary from patient to patient depending upon anatomy, body habitus, prior surgery, and the presence and extent of bowel gas.
 - 3.4. The renal arteries should be identified and evaluated for color flow changes that would indicate an actual flow change, change in residual lumen, and particularly, the presence of imaged plaque. An attempt should be made to follow each renal artery distally to the kidney if possible.
 - 3.5. Spectral waveforms should be taken at an appropriate (60 degrees or less) Doppler angle at the ostium, proximal, mid and distal segments of each renal artery, the renal hilum and within the upper, mid and lower pole of the renal cortex and medulla. Additionally, a real time spectral trace is obtained throughout any suspected region of stenosis.
 - 3.6. Renal parenchymal pathology should be documented (cyst, mass, hydronephrosis, stones, etc.) with B-mode imaging. Kidney length should be measured in the longest sagittal dimension. Generally, multiple measurements should be performed and a smaller kidney should be re-examined to rule out technical error.
 - 3.7. Accessory and/or multiple renal arteries present in approximately 20% of the population. The use of color flow imaging may facilitate detection of these vessels.
 - 3.8. The renal veins are identified and patency is confirmed with optimized color or power Doppler and spectral Doppler.
 - 3.9. The aorta is identified and should be interrogated with B-Mode and color flow imaging from the level of the diaphragm through its bifurcation into the right and left common iliac arteries in both transverse and sagittal planes. Aortic diameter, the presence and location of atherosclerotic plaque and evidence of disordered flow patterns should be documented as appropriate. Angle corrected Doppler spectral waveforms should be recorded from the aorta at the level of the celiac axis and superior mesenteric artery (SMA). The peak systolic aortic velocity is retained for comparison with renal artery velocities.
 - 3.10. The celiac axis, SMA, and inferior mesenteric artery (IMA) should be located and may also be interrogated according to the protocol for those vessels.

- 3.11 Although the renal duplex scan evaluation of the kidneys is directed toward identification of vascular abnormalities, it is helpful to have a basic understanding of other kidney pathology that may be incidentally identified while assessing the vasculature. Correlative imaging may be requested as clinically indicated and/or appropriate.
- 3.12 The patient's clinical status should be re-assessed prior to discharge.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The technologist/sonographer/examiner should:

- 4.1 Review data acquired during the Renal Artery Duplex Examination to ensure that a complete and comprehensive evaluation has been performed and documented.
- 4.2 Explain and document any exceptions to the routine Renal Artery Duplex Examination protocol (i.e., study omissions or revisions).
- 4.3 Record all technical findings required to complete the final diagnosis on a worksheet so that the findings can be classified according to the laboratory diagnostic criteria (these criteria may be based on published or internally generated data, but must be internally validated regardless of the source).
- 4.4 Document study results, exam performance, preliminary interpretation and final diagnosis in a laboratory logbook.
- 4.5 Alert the medical director or other responsible physician when immediate medical attention is indicated based on the Renal Artery Duplex Examination findings and local protocols.

GUIDELINE 5: PRESENTATION OF EXAM FINDINGS

The technologist/sonographer/examiner should:

- 5.1 Provide preliminary interpretation of the renal artery duplex according to institutional policies.
- 5.2 Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician for use in rendering a diagnosis and for archival purposes.

GUIDELINE 6: EXAM TIME RECOMMENDATIONS

High quality and accurate results are fundamental elements of the Renal Artery Duplex Examination. A combination of direct and indirect exam components is the foundation for maximizing exam quality and accuracy.

- 6.1 Indirect exam components include pre-exam procedures: obtaining previous exam data, completing pre-exam paperwork, and exam room and equipment preparation; patient assessment, history, and positioning (Guideline 1); and post exam procedures: clean up; compiling, processing, and reviewing data for preliminary and/or formal interpretation (Guidelines 3 and 4); patient communication (Guideline 5); exam charge and billing activities. Recommended time is 30-35 minutes.
- 6.2 Direct exam components include equipment optimization, patient positioning throughout the exam, and the actual hands examination process. (Guideline 2) Recommended time is 60-90 minutes.

GUIDELINE 7: CONTINUING PROFESSIONAL EDUCATION

Certification is considered the Guideline of practice in vascular technology. It measures an individual's competence to perform vascular technical examinations at the entry level. After achieving certification, all Registered Vascular Technologists must remain current with:

- 7.1 Advances in diagnosis and treatment of peripheral and renal vascular disease.
- 7.2 Renal Artery Duplex Examination protocols and published laboratory diagnostic criteria.
- 7.3 Advances in duplex ultrasound technology and other correlative imaging techniques used for the evaluation of renal arteries and kidneys.

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