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**VASCULAR TECHNOLOGY
PROFESSIONAL PERFORMANCE GUIDELINES**

Lower Extremity Arterial Duplex Evaluation

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PURPOSE

Duplex ultrasound of the lower extremity arteries is performed to provide an overview of the location, extent and severity of vascular disease. The ultrasound evaluation can be performed from the abdominal aorta through the tibial vessels and extended into the foot in order to facilitate clinical management decisions.

APPROPRIATE INDICATIONS

Common indications for lower extremity arterial duplex imaging include, but are not limited to:

- Claudication
- Ischemic rest pain
- Arterial ulceration
- Peripheral arterial disease (PAD)
- Suspected arterial embolization
- Follow-up endovascular procedure (e.g., angioplasty, stent)
- Bypass graft
- Pseudo-aneurysm
- Arterio-venous fistula
- Hemodialysis access
- Trauma

CONTRAINDICATIONS AND LIMITATIONS

Contraindications for lower extremity arterial duplex imaging include, but are not limited to:

- Lower extremity contractures and/or edema/swelling
- Casts, dressings, open wounds

PATIENT COMMUNICATION

Prior to beginning the exam, the sonographer or examiner should:

- Introduce self and explain why the examination is being performed and indicate how much time the examination will take.
- Verify the patient's name and date of birth or utilize facility specific patient identifiers.
- Explain the procedure, taking into consideration the age and mental status of the patient and ensuring that the necessity for each portion of the evaluation is clearly understood.
- Respond to questions and concerns about any aspect of the evaluation.
- Educate the patient about risk factors and symptoms of peripheral arterial disease
- Refer specific diagnostic, treatment or prognosis questions to the patient's physician.

PATIENT ASSESSMENT

A patient assessment should be completed before the evaluation is performed. This includes assessment of the patient's ability to tolerate the procedure and evaluation of any contraindications to the procedure. The sonographer or examiner should obtain a complete, pertinent history by interview of the patient or patient's representative and review of the patient's medical record, if available. A pertinent history includes:

- Previous cardiovascular surgeries
- Current medications or therapies
- Presence of risk factors for peripheral arterial disease
 - Diabetes
 - Hypertension
 - Hyperlipidemia
 - Age
 - Smoking
 - Obesity
 - Cerebrovascular disease
 - Coronary artery disease
 - Family history of PAD
- Presence of symptoms for peripheral arterial disease
 - Claudication
 - Rest pain
 - Ulceration
 - Gangrene
 - Ischemia
 - Hair loss
 - Pallor
 - Dependent rubor
- Results of other relevant diagnostic procedures
- Review of prior examinations to ensure that the evaluation duplicates prior imaging and Doppler parameters.
- Verify that the requested procedure correlates with the patient's clinical presentation

PATIENT POSITIONING

The optimal patient positioning for performing a lower extremity arterial duplex examination is:

- Supine
- Leg to be examined is externally rotated

INSTRUMENTATION

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

- Typically, a linear 5-7 MHz transducer
 - Superficial structures may require a higher frequency transducer
 - Deeper structures or edematous tissue may require a lower frequency transducer
 - Aorto-iliac imaging requires a lower frequency 2-5 MHz curvilinear or phased array transducer
- Display of two-dimensional structure and motion in real-time
 - Doppler ultrasonic signal documentation
 - Spectral analysis with color and/or power Doppler imaging
- Digital storage of static images and/or cine loop is required

EXAMINATION PROTOCOL

Sonographers should follow a standard imaging protocol. A complete evaluation includes B-mode imaging, spectral Doppler analysis, and color Doppler imaging of all accessible portions of the lower extremity arteries. Studies may be unilateral or limited based on laboratory specific protocols.

Throughout each examination, the sonographer or examiner should:

- Observe sonographic characteristics of normal and abnormal tissues, structures, and blood flow, allowing necessary adjustments to optimize exam quality.
- Assess and monitor the patient's physical and mental status, allowing modifications to the procedure plan according to the patient's clinical status.
- Analyze sonographic findings to ensure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.
- Accurately annotate B-mode, color and spectral Doppler images.

Physiological testing, such as an ankle brachial index (ABI), segmental pressures, pulse volume recordings and Doppler waveform analysis, is often performed to identify significant arterial disease and determine if further imaging is warranted. These studies are not equivalent to arterial Duplex imaging. An initial ABI is typically obtained, in conjunction with Duplex imaging, to support sonographic findings and avoid discrepancies.

B-Mode and color Doppler imaging of the lower extremity arteries should be performed in a longitudinal plane. Transverse imaging may be helpful. Longitudinal grayscale and color Doppler images should be documented for each normal arterial segment and in areas of stenosis, previous intervention or other abnormality. Color Doppler is used to localize areas of flow disturbance and stenosis. Power Doppler is useful to confirm possible vessel occlusion or low flow states.

- **Longitudinal B-mode and/or color Doppler images** include the following:
 - Common femoral artery (CFA)
 - Proximal deep/profunda femoral artery (DFA/PFA)
 - Proximal, mid and distal Superficial femoral artery (SFA)
 - Popliteal artery (PopA)
 - Tibial and peroneal arteries (where adequately visualized)
 - Aorta, common and external iliac arteries (when indicated)
 - Areas of previous angioplasty or stenting
 - **Bypass graft evaluations** include B-mode and color Doppler images from:
 - Proximal and distal anastomoses
 - Abnormalities require additional images when present
 - The location, severity and characteristics of plaque should be documented in transverse and longitudinal planes

Doppler spectral analysis is used to quantify disease severity. Spectral Doppler waveforms should be obtained in a longitudinal plane at an angle of 60° and parallel to the direction of blood flow/vessel walls. Maintain Doppler angles between 45° and 60° whenever possible. Angles greater than 60° must be avoided.

Peak systolic velocities should be documented for each normal arterial segment and in areas of stenosis, previous intervention or other abnormality. Spectral Doppler waveforms and velocity measurements should be obtained 1-4cm proximal to, at and distal to sites of suspected stenosis, obstruction or in areas of previous intervention.

- **Spectral Doppler waveforms** and velocity measures include:
 - Common femoral artery
 - Proximal deep/profunda femoral artery
 - Proximal, mid and distal portions of the superficial femoral artery
 - Popliteal artery
 - The tibial/peroneal trunk (when adequately visualized)
 - The tibial and peroneal arteries (where adequately visualized)
 - Aorta, common iliac and external iliac arteries (when indicated)
 - Areas of previous endovascular intervention (angioplasty, stenting)
 - Spectral waveforms proximal to the intervention site, within the intervention site, and distal to the intervention site.
 - **Bypass graft evaluations** include waveforms and velocities from:
 - Inflow and outflow arteries
 - Proximal and distal anastomoses
 - Proximal, mid and distal portions of the bypass graft
 - Abnormalities require additional images when present

- In the presence of pathology, spectral waveforms should be recorded proximal to, within, and distal to the lesion.

REVIEW OF DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review data acquired during the lower extremity arterial duplex ultrasound exam to ensure that a complete and comprehensive evaluation has been performed and documented.
- Explain and document any exceptions to the protocol (i.e., study omissions or revisions).
- Determine any change in follow-up studies, review previous exam documentation so that the current evaluation can document any change in status; and, to duplicate prior imaging and Doppler parameters.
- Record technical findings required to complete the final diagnosis on a worksheet or other appropriate method (e.g., computer software), so that the findings can be classified according to the laboratory diagnostic criteria.
- Document the exam date, clinical indications, sonographer performing the evaluation, and exam summary in the patient's medical record.

PRESENTATION OF EXAM FINDINGS

The sonographer or examiner should:

- Provide preliminary results when necessary as provided for 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.
- Sonographer and interpreting physician name must appear on the final report. Finalized/signed report should be available within four business days.
- Alert vascular laboratory Medical Director or appropriate health care 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 lower extremity arterial 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, 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).
 - 93925 94 minutes
 - 93926 60 minutes

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