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Lower Extremity Arterial Duplex Evaluation

**PURPOSE**
Duplex ultrasonography 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.

**COMMON INDICATIONS**
Some of the common indications for performance of lower extremity arterial duplex imaging include:
- Evaluation or follow-up of patients with claudication, ischemic rest pain, and/or arterial ulceration
- Assessment of patients with known arterial disease
- Pre-procedure assessment for planning of intervention
- Follow-up to determine technical adequacy of surgical intervention, i.e., post angioplasty and/or stent placement
- Follow-up of bypass grafts to detect intrinsic stenosis or progression of disease, which may threaten graft patency
- Evaluation of aneurysm, pseudoaneurysm, arterial-venous fistula, and hemodialysis access
- Evaluation of arterial trauma

**CONTRAINDICATIONS AND LIMITATIONS**
Contraindications for lower extremity arterial duplex are few, however, some limitations exist and may include the following:
- Presence of ulcers, casts, or bandages
- Presence of contractures of lower extremity
GUIDELINE 1: PATIENT COMMUNICATIONS AND POSITIONING

The technologist/sonographer/examiner should:

1.1 Introduce self and explain why the examination is being performed and indicate how much time the examination will take.

1.2 Explain the procedure to the patient, taking into consideration the age and mental status of the patient and 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 the patient regarding exercise program benefit

1.5 Refer specific diagnostic, treatment or prognosis questions to the patient's physician

1.6 Patient should be supine with the heart at approximately the same level of the extremities

GUIDELINE 2: PATIENT ASSESSMENT

Patient assessment must be performed before evaluation is performed. This includes assessment of the patient’s ability to tolerate the procedure and an evaluation of any contraindications to the procedure.

The technologist/sonographer/examiner should:

2.1 Obtain a complete and pertinent history by interview of the patient or their representative and/or review of the patient’s medical record. A pertinent history includes:
   a. Current medical status
   b. Presence of any signs or symptoms of peripheral vascular disease: claudication, rest pain, ulceration, gangrene, ischemia, hair loss, coolness, pallor, dependent rubor
   c. Note relevant risk factors for peripheral vascular disease: diabetes; hypertension; hyperlipidemia, age, smoking, obesity, cerebrovascular disease; coronary artery disease; and family history of peripheral arterial disease or any of the above.
   d. Current medications or therapies
   e. Results of other vascular studies
   f. Results with types and dates of prior vascular interventions, if possible

2.2 Complete a limited or focused physical exam, which includes palpation of pulses at all levels and document trophic changes according to lab specific protocol.

GUIDELINE 3: EXAMINATION GUIDELINES

Throughout each exam, sonographic characteristics of normal and abnormal tissues, structures, and blood flow must be observed so that scanning technique can be adjusted as necessary to optimize image quality and spectral waveform characteristics. The patient's physical and mental status is assessed and monitored during the examination, and modifications are made to the procedure plan according to changes in the patient's clinical condition during the procedure. Sonographic findings are analyzed throughout the course of the examination to ensure that sufficient data is provided to the interpreting/referring physician to direct patient management and render a final diagnosis.
INSTRUMENTATION:

3.1 Use appropriate duplex instrumentation, which includes display of both two-dimensional structure and motion in real time and Doppler ultrasonic signal documentation:
   a. Spectral analysis with color and/or power Doppler imaging
   b. Imaging and Doppler carrier frequency of 3.5 to 10 Mhz
   c. Hardcopy paper, film or digital storage capabilities

3.2 Follow a standard exam protocol for the evaluation. The standard exam will require multiple acoustic windows and patient positioning techniques and may include the evaluation of the following vessels in their entirety: (if required by individual laboratory protocol)
   a. Aorta
   b. Common iliacs (CIA)
   c. External iliac (EIA); internal iliac only in select cases
   The following vessels should be included for evaluation in most instances:
   d. Common femoral (CFA)
   e. Profunda femoris
   f. Superficial femoral (SFA)
   g. Popliteal
   h. Anterior tibial (ATA)
   i. Posterior tibial (PTA)
   j. Peroneal arteries

3.3 Evidence of plaque formation, wall calcification, length of narrowing, plaque character in larger vessels or dilatation (by diameter) should be documented.

3.4 Ankle pressures are obtained and an ankle brachial index is calculated as a baseline. Toe brachial index should be included according to lab protocol. (See documentation in Lower Extremity Arterial Segmental Physiologic Evaluation Guideline.) Doppler spectral analysis is used to quantify disease severity and should, in general, include:
   a. Assessment for presence or absence of flow.
   b. When flow is present, the evaluation of peak systolic velocity, end diastolic velocity, and waveform analysis should be performed as needed (e.g., systolic upstroke/acceleration time, pulsatility, spectral broadening, turbulence and flow directions). At a minimum, spectral analysis should be obtained in all vessel segments as well as proximal, throughout and distal to any region where flow disturbance is identified.
   c. All Doppler derived velocity information must be performed at an angle of 60 degrees or less with respect to the direction of blood flow, as well as keeping the Doppler cursor alignment parallel to the vessel walls.
   d. Anatomic variants should be documented.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC ULTRASOUND EXAM FINDINGS

The technologist/sonographer/examiner should:

4.1 Review data acquired during the examination to ensure that a complete and comprehensive evaluation has been performed and documented.
4.2 Explain and document any exceptions to the routine Lower Extremity Arterial Duplex Examination protocol (i.e., study omissions or revisions).

4.3 Record all technical findings required to complete the final interpretation on a worksheet, logbook or other format, so that the findings can be classified according to the laboratory’s diagnostic criteria based on published or internally validated data.

4.4 Document the exam date, clinical indication(s), technologist performing the exam, and the exam summary in a vascular laboratory log book or other appropriate method, i.e., computer software.

4.5 Alert the laboratory Medical Director or health care provider when immediate/urgent medical attention is indicated based on the findings.

**GUIDELINE 5: PRESENTATION OF EXAM FINDINGS**

The technologist/sonographer/examiner should:

5.1 Provide preliminary results when necessary as provided for by internal guidelines.

5.2 Present record of 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 lower extremity arterial 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 the following pre-exam procedures: obtaining previous exam data, completing pre-exam paperwork; exam room and equipment preparation; patient assessment, history, and positioning (Guideline 1 & 2); and the post exam procedures include: clean up; compiling, processing, and reviewing data for preliminary and/or formal interpretation (Guidelines 3 and 4); patient communication (Guideline 2); exam charge and billing activities. Recommended time is 30 minutes.

6.2 Direct exam components include equipment optimization, patient positioning throughout the exam, and the actual hands-on examination process. (Guideline 3) Recommended time is 50 minutes.

**GUIDELINE 7: CONTINUING PROFESSIONAL EDUCATION**

Certification is considered the standard of practice in vascular technology. It measures an individual’s competence to perform vascular technology at the entry level. After achieving certification from either ARDMS (RVT credential), or ARRT (VT) an individual must keep current with:

7.1 Advances in diagnosis and treatment of peripheral vascular disease (PVD) disease

7.2 Changes in Lower Extremity Arterial Duplex Examination protocols or published laboratory diagnostic criteria

7.3 Advances in ultrasound technology used for the Lower Extremity Arterial Duplex Examination

7.4 Advances in other technology used for the Lower Extremity Arterial Duplex Examination
APPENDIX

It is recommended that published or internally generated diagnostic criteria should be validated for each ultrasound system used. When validating ultrasound diagnostic criteria, it is important to realize that equipment, operator and interpretation variability is inherent to this process.

REFERENCES

- SVU Professional Performance DVD -- "Lower Extremity Arterial and Bypass Graft Duplex Examination." Produced by GE Healthcare and SVU. Narration and comment by Kupinski, AM, and Zang, W. June 2009.