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VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Upper Extremity Arterial Duplex Evaluation

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Upper Extremity Arterial Duplex Evaluation

PURPOSE

Duplex ultrasonography of the upper 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 subclavian artery to the wrist to facilitate clinical management decisions.

COMMON INDICATIONS

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

- Evaluation or follow-up of patients with exercise related/induced pain, ischemic rest pain, and/or arterial ulceration
- Assessment of patients with documented 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 stenoses or progression of disease, which may threaten graft patency
- Evaluation of aneurysm, pseudoaneurysm and arterial-venous fistula
- Evaluation of arterial trauma

CONTRAINDICATIONS AND LIMITATIONS

Contraindications for upper extremity arterial duplex are few; however, some limitations exist and may include the following:

- Presence of ulcers, casts, or bandages
- Obesity
- IV or catheters that limit access to or visualization of arterial structures
- Patients' inability to cooperate with or tolerate the examination

GUIDELINE 1: PATIENT COMMUNICATIONS AND POSITIONING

The technologist/sonographer/examiner should:

- 1.1 Introduce self to the patient and explain why the Upper Extremity Arterial 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 patient about risk factors and symptoms of Peripheral Vascular Disease (PVD).
- 1.5 Educate patient regarding exercise program benefit.
- 1.6 Refer specific diagnostic, treatment or prognosis questions to the patient's physician.
- 1.7 Make sure patient is supine with the heart at approximately the same level of the extremities.

GUIDELINE 2: PATIENT ASSESSMENT AND PHYSICAL EXAMINATION

Patient assessment must be performed before the Upper Extremity Arterial Duplex Imaging. 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:

- 2.1 Obtains a complete, pertinent history by interview and/or review of the patient's medical record. A pertinent history includes:
 - a. Current medical status, especially regarding arterial stenoses
 - b. Presence of any signs or symptoms of peripheral vascular disease: claudication, rest pain, ulceration, gangrene, ischemia, hair loss, coolness, pallor, dependent rubor
 - c. Relevant risk factors for peripheral vascular disease: diabetes, hypertension, age, smoking, obesity, cerebrovascular disease, coronary artery disease, hyperlipidemia, or family history of: peripheral vascular disease, diabetes or hypertension;
 - d. Relevant medications or therapies
 - e. Results of prior vascular studies
 - f. Types of prior vascular interventions
- 2.2 Performs a limited or focused physical exam, according to laboratory Medical Director wishes, which may include:
 - a. palpation of pulses at all levels,
 - b. auscultation for carotid and subclavian bruits
 - c. documentation of trophic changes.

GUIDELINE 3: EXAMINATION GUIDELINES

Diagnostic criteria for the duplex examination must include application of published criteria or internally generated criteria. All diagnostic criteria must be internally validated. Bilateral blood pressures should be taken prior to duplex imaging and documented to provide information regarding possible pre-existing stenosis. For a full physiologic examination, including PVR, segmental blood pressures, and segmental CW Doppler waveforms see *Upper Extremity Arterial Segmental Physiologic Evaluation*.

Gray scale imaging is used to identify and follow the selected vessel segments and to note the presence or absence of any disease process within the vessel lumen. Doppler spectral analysis is used to quantify disease severity and should, in general, include assessment for presence or absence of flow and evaluation of peak systolic velocity, end diastolic velocity, and waveform analysis [e.g., systolic upstroke/acceleration, pulsatility, spectral broadening, turbulence and flow direction] or classified at each segment as bidirectional, multidirectional, monophasic as needed. At a minimum, spectral analysis should be obtained in all vessel segments identified. All spectral derived velocity information is obtained with an appropriate Doppler angle of 60 degrees or less.

- 3.1 The patient's physical and mental status is assessed and monitored during the examination, with modifications made to the procedure plan according to changes in the patient's clinical 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 Use appropriate duplex instrumentation, which includes display of both two-dimensional B-mode imaging and Doppler spectral waveform analysis of flow dynamics. Color flow and power Doppler imaging may complement the study.
 - a. Doppler spectral analysis
 - b. Doppler frequency of 3.5-10MHz. 15MHz may be helpful with smaller arm vessels.
 - c. Hardcopy capabilities: film or digital storage of static images, videoclips. Video-tape may be used.
- 3.3 Follows a standard exam protocol for each segment evaluated. Studies may be unilateral or bilateral. If not contraindicated, bilateral systolic arm pressures should be documented to elicit the presence or absence of equal readings. The subclavian, axillary, brachial, radial and ulnar arteries should all be interrogated in their entirety, if a complete duplex evaluation is deemed necessary.
- 3.4 All of the vessels interrogated should have spectral Doppler waveforms recorded with a minimum peak systolic velocity measurement.
- 3.5 Interrogation of the chosen conduit (i.e.; arteries, bypass grafts, fistulas, or stents) should include the proximal, mid, and distal segments and anastomotic sites.
- 3.6 If disease sites are identified, Doppler spectral velocity measurements should be documented throughout the area being evaluated.
- 3.7 If diagnostic criteria include calculation of a ratio, the proximal spectral waveform with peak systolic velocity should be obtained at the time an abnormal velocity is found, in order to obtain a ratio if desired (according to lab criteria).

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The technologist/sonographer/examiner:

- 4.1 Reviews data acquired during the Upper Extremity Arterial Duplex Examination to ensure that a complete and comprehensive evaluation has been performed and documented.

- 4.2 Explains and documents any exceptions to the routine Upper Extremity Arterial Duplex Examination protocol (i.e., study omissions or revisions).
- 4.3 Records all technical findings required to complete the final interpretation on a worksheet so that the measurements can be classified according to the laboratory diagnostic criteria (these criteria may be based on either published or internally generated data but must be internally validated regardless of the source). (see appendix)
- 4.4 Completes required laboratory documentation of the study.
- 4.5 Alerts medical director or other responsible physician when immediate attention is indicated, based on the Upper extremity Arterial Duplex examination findings.

GUIDELINE 5: PRESENTATION OF FINDINGS

The technologist/sonographer/examiner:

- 5.1 Provides preliminary results as provided for by internal policy based on upper extremity examination findings.
- 5.2 Presents record of diagnostic images, velocity spectral data, explanations for suboptimal exams, and technical worksheet to the interpreting physician for use in rendering a diagnosis and for archival purposes.
- 5.3 Alerts vascular laboratory medical director or appropriate health care provider when immediate medical attention is indicated.

GUIDELINE 6: EXAM TIME RECOMMENDATIONS

High quality and accurate results are fundamental elements of the upper 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 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 post exam procedures: 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 15 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 35 - 45 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 CCI (RVS credential) or ARRT (RT-V credential), the individual must keep current with:

- 7.1 Advances in diagnosis and treatment of peripheral vascular disease (PVD)
- 7.2 Changes in Upper Extremity Arterial Duplex Examination protocols or published laboratory diagnostic criteria
- 7.3 Advances in ultrasound technology used for the Upper Extremity Arterial Duplex Examination
- 7.4 Advances in other technology used for the Upper 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.

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