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**VASCULAR TECHNOLOGY
PROFESSIONAL PERFORMANCE GUIDELINES**

Upper Extremity Arterial Segmental Physiologic Evaluation

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Upper Extremity Arterial Segmental Physiologic Evaluation

PURPOSE

Arterial segmental pressure and waveform evaluations are performed to evaluate the upper extremity arteries to determine the presence, severity, and location of arterial occlusive disease or absence of pathology.

COMMON INDICATIONS

Some of the more common indications for performance of arterial segmental pressures and waveforms include, but are not limited to:

- Arterial insufficiency
- Thoracic Outlet Syndrome (TOS)
- Raynaud's Disease
- Ischemic ulcer
- Limb ischemia/ Digital ischemia

Upper extremity arterial segmental pressure and waveform evaluations are also performed as follow-up of patients with known peripheral artery disease or an arterial intervention of the upper extremity.

CONTRAINDICATIONS AND LIMITATIONS

- Functioning dialysis access graft
- Patients with suspected or known acute deep venous thrombosis (DVT).
- Recent surgery, ulcers, casts or bandages on the upper extremity that cannot or should not be compressed by cuff
- Patients with incompressible vessels
- Patients who are post upper extremity interventional procedure, i.e., dialysis access graft, stent, arterial bypass graft, segmental pressures may be contraindicated.

GUIDELINE 1: PATIENT COMMUNICATION AND POSITIONING

- 1.1 Introduces self and explains why the Upper Extremity Arterial Segmental Physiologic Evaluation is being performed and indicates how long it will take.
- 1.2 Explains the procedure to the patient, taking care to ensure that the patient understands the necessity for each aspect of the evaluation.
- 1.3 Responds to questions and concerns about any aspect of the Upper Extremity Arterial Segmental Physiologic Evaluation.
- 1.4 Educates patients about risk factors for and symptoms of peripheral arterial disease.
- 1.5 Informs patients about necessary life style changes due to peripheral arterial disease. Refers specific diagnostic, treatment or prognosis questions to the patient's physician.
- 1.6 The patient should have rested for at least 15 minutes.
- 1.7 Patients are supine for segmental pressures and Doppler waveforms.

GUIDELINE 2: PATIENT ASSESSMENT

Patient assessment must be performed before the Upper Extremity Arterial Segmental Physiologic Evaluation is performed. This includes assessment of the patient's ability to tolerate the procedure and an evaluation of any contraindications to the procedure.

- 2.1. Obtains a complete, pertinent history by interview of the patient or patient's representative and review of the patient's medical record. A pertinent history includes:
 - a. Current medical status
 - b. Previous vascular/cardiovascular surgeries
 - c. Current medications or therapies
 - d. Presence of any risk factors for arterial disease: diabetes; hypertension; peripheral vascular disease; coronary artery disease; family history of arterial disease, coronary artery, or vascular disease; family history of diabetes or hypertension; age; smoking; job description; scleroderma condition.
 - e. Presence of any symptoms of peripheral arterial disease: limb ischemia; skin changes; bruits.
- 2.2 When directed, perform adjunctive procedures: auscultation of bruits (carotid, orbital, subclavian); palpation of pulses (brachial, radial, carotid, facial); Allen's Test.
- 2.3 Verify that the requested procedure correlates with the patient's clinical presentation.

GUIDELINE 3: EXAMINATION GUIDELINES

Throughout each exam, characteristics of normal and abnormal waveform and segmental pressures must be observed so that the testing technique can be adjusted as necessary. 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, segmental pressure and waveform 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.

- 3.1 Use appropriate instrumentation, which includes a display of the Doppler or plethysmographic waveforms and segmental pressure measurements:
 - a. Waveform output and display capabilities
 - b. Doppler carrier frequency of at least 5.0 MHz
 - c. Doppler carrier frequency of at least 8.0 MHz

- d. Blood pressure cuffs (arm and digital) of varied width and length. Pressure artifacts occur when the cuff size is not appropriate for the girth of the arm or digit of the individual patient.
 - e. Hardcopy paper, film or digital storage capabilities
- 3.2 Follow a standard exam protocol for each upper extremity. Physiological waveform analysis is typically Doppler or air plethysmography in origin. Segmental waveform and pressure information is used to identify the presence, absence, location and the severity of disease.
- a. Doppler Waveforms: At least three representative Doppler waveforms are recorded in the brachial, radial and ulnar arteries. All Doppler waveforms must be performed at a 45-degree angle to the skin or area being insonated. At least three representative waveforms should be obtained at all levels. Gain settings should be optimized.
 - 1. Audio interpretation of the signals should attempt to classify the signals as triphasic, biphasic, or monophasic.
 - b. Air Plethysmography Waveforms: At least three representative air plethysmography waveforms must be obtained. Typical recording include waveforms from the upper arm, forearm and wrist. Standardized inflation pressures must be used in all pulse volume cuffs. Gain settings should be optimized. Systolic segmental pressures should be recorded at the brachial, radial and ulnar arteries, bilaterally. The radial or ulnar artery with the greatest pressure is used to take the arm pressure measurements.
- 3.3 Additional waveform and/or pressure analyses may include the palmer arches, subclavian, axillary and digital arteries. Gain settings should be optimized.
- 3.4 When testing for Thoracic Outlet Syndrome (See SVU Guideline for TOS)
- 3.5 When testing for Vasospastic Disease, PPG waveforms and/or digital surface temperatures are obtained from all (1-5) digits, bilaterally at room temperature and following digital immersion in iced water for two minutes. PPG gain settings and chart speed should be standardized.
- 3.6 To determine any change in follow-up studies, review previous exam documentation so that the current evaluation can document a change in status. The examination protocol may need to be modified to address previous findings and current physical needs.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

- 4.1 Review data acquired during the Upper Extremity Arterial Segmental Physiologic Evaluation to ensure that a complete and comprehensive evaluation has been performed and documented.
- 4.2 Explain and document any exceptions to the routine Upper Extremity Arterial Segmental Physiologic Evaluation protocol (i.e., study limitations, omissions or revisions).
- 4.3 Record all technical findings required to complete the final diagnosis on a worksheet, logbook or other appropriate form so that the measurements can be classified according to the laboratory diagnostic criteria (based on published or internally validated data).
- 4.4 Document exam date, clinical indication(s), technologist performing the evaluation and exam summary in a laboratory logbook or other appropriate method, i.e. computer software.
- 4.5 Alert the vascular laboratory Medical Director or appropriate health care provider when immediate medical attention is indicated based on the Upper Extremity Arterial Segmental Physiologic Evaluation findings.

GUIDELINE 5: PRESENTATION OF EXAM FINDINGS

- 5.1 Provides preliminary results when necessary as provided for by internal guidelines based on the Upper Extremity Arterial Physiologic Evaluation findings.
- 5.2 Presents 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 Upper Extremity Arterial Segmental Physiologic Evaluation. A combination of indirect and direct 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 preparatory activities; patient assessment and positioning (Guideline 1 & 2); patient communication (Guideline 2); post-exam activities: exam room cleanup; compiling, reviewing and processing exam data for preliminary and/or formal interpretation (Guidelines 4-5); and, patient charge and billing activities. Recommended time allotment is 30 minutes.
- 6.2 Direct exam components include equipment optimization and the actual hands-on, examination process (Guideline 3). Recommended time allotment is 35-45 minutes.

GUIDELINE 7: CONTINUING PROFESSIONAL EDUCATION

Certification is considered the standard of practice in vascular technology. It demonstrates an individual's competence to perform vascular technology at the entry level. After achieving certification, all Registered Vascular Technologists (RVTs) must keep current with:

- 7.1 Advances in diagnosis and treatment of peripheral arterial disease.
- 7.2 Changes in Upper Extremity Arterial Segmental Physiologic Evaluation protocols or published laboratory diagnostic criteria.
- 7.3 Advances in ultrasound technology used for the Peripheral Arterial Evaluation.
- 7.4 Advances in other technology used for the Peripheral Arterial Evaluation.

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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