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## **VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES**

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# Stress Testing For Cold Sensitivity

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# Stress Testing For Cold Sensitivity

## PURPOSE

Cold stress evaluations are performed to assess the changes in the circulation of the digits in response to an induced vasospasm. To assess and determine the presence or absence of pathology in the upper extremities, and to differentiate between Primary and Secondary Raynaud's.

## COMMON INDICATIONS

Some of the more common indications for performance of Cold Stress Evaluations include:

- Color changes of the hands or fingers when exposed to cold stimulus
- Arterial insufficiency
- Thoracic Outlet Syndrome
- Pain or parasthesia

## CONTRAINDICATIONS AND LIMITATIONS

- Cold stress evaluation is contraindicated in patients with open areas or ulceration of the fingers.
- Abnormal digital pressures may be a sign of secondary Raynauds and care should be used in placing the hands in ice water
- Symptoms isolated to individual fingers rather than uniform involvement of both hands suggests the presence of isolated digital artery disease and care must be taken if immersion in ice water is being considered.

## **GUIDELINE 1: PATIENT COMMUNICATIONS AND POSITIONING**

- 1.1 Explains why the Segmental Pressures, Doppler Waveform and Cold Stress Examination 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 Segmental Pressures, Doppler Waveform and Cold Stress Evaluation.
- 1.4 Educates patients about risk factors for and symptoms of peripheral arterial disease and Raynaud's.
- 1.5 Informs patients about necessary life style changes due to peripheral arterial and Raynaud's diseases.
- 1.6 Refers specific diagnostic, treatment or prognosis questions to the patient's physician.
- 1.7 Patients are supine for segmental pressures and Doppler waveforms. Patients are in a seated position with the hands resting on the knees, palm up for pre- and post-measurement of temperatures and submersion into the ice water bath.

## **GUIDELINE 2: PATIENT ASSESSMENT**

Patient assessment must be performed before the cold stress examination is performed. It includes assessment of the patient's ability to tolerate the procedure and an evaluation of any contra-indications to the procedure. Cold stress is usually performed after segmental pressures and Doppler waveforms of the upper extremities and digits are documented.

- 2.1 Obtains a complete, pertinent history by interview of the patient or patient's representative and review of a patient's medical record. A pertinent history includes:
  - a. current medical status
  - b. previous vascular/cardiovascular surgeries
  - c. current medications or therapies or presence of any risk factors for arterial disease or cold sensitive conditions: diabetes, hypertension, peripheral vascular disease, coronary artery disease, family history of arterial disease, coronary or vascular disease, family history of diabetes, hypertension; age; smoking, collagen disorders (Scleroderma), rheumatic diseases (rheumatoid arthritis, systemic lupus erythematosus); hormone imbalance (hypothyroidism and carcinoid); medications that induce cold sensitive states; arsenic poisoning or trauma; or occupational trauma
  - d. presence of any symptoms for cold sensitivity or peripheral arterial disease: pain or parasthesia of the hands, fingers or toes, triphasic color changes of the digits or limb weakness or pain
- 2.2 Verifies that the requested procedure(s) correlates with the patient's clinical presentation.

### **GUIDELINE 3: EXAMINATION GUIDELINES**

Throughout each exam, characteristics of normal and abnormal photoplethysmographic or PVR waveforms and digital blood pressures must be observed so that testing techniques can be adjusted as necessary to optimize waveform quality. 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 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. Uses appropriate instrumentation, which includes photoplethysmographic, pulse volume, digital thermistors, Doppler waveforms and segmental pressure measurements:
  - a. Photoplethysmograph and/or Pulse Volume Recorder
  - b. PPG sensors
  - c. Appropriate size blood pressure cuffs
  - d. Thermister probes and thermometer which registers temperatures from 0 to 55°C
  - e. Hardcopy capabilities
  - f. Analog waveform analysis
  - g. Doppler carrier frequency of at least 5.0 MHz
  - h. Doppler carrier frequency of at least 8.0 MHz
  - i. Disposable gloves, non-sterile
  
- 3.2 Follows a standard exam protocol for each peripheral arterial study and cold stress evaluation. All studies should be bilateral. The standard exam includes a standard upper extremity arterial examination prior to cold stress evaluation. This allows for differentiation between Primary and Secondary Raynaud's. Doppler waveform analysis obtained at the subclavian, axillary, brachial, radial, and ulnar arteries. Data interpretation should attempt to classify the presence, severity and location of disease. All Doppler waveforms must be performed at an angle between 45 and 60 degrees with respect to the direction of blood flow. At least three representative Doppler waveforms are recorded in the subclavian, axillary, brachial, radial and ulnar arteries. Doppler information is used to identify the presence, absence, location and the severity of the disease. Segmental pressures should be recorded in the upper arm and in the forearm. An upper and lower forearm can also be taken, when appropriate cuff size is available for the wrist. Additional waveform analysis includes the palmar arches and digital arteries. PPG or PVR waveforms and segmental blood pressures of all digits, as well as temperatures of all digits, are recorded prior to submersion of the hand or foot into an ice water bath, with the submersion duration from 40 seconds up to 3 minutes or patient tolerance. If all are similar prior to submersion, record temperatures and digital blood pressures from a representative digit on each hand, post submersion, until temperature returns to pre exposure or for a period of 10 minutes. Application of extra large size disposable gloves for submersion will prevent having to dry the hands and prevent chilling from water evaporation on the hands. The thermister gauge may be left in place while the hands are submerged in the ice water bath. After hand or foot is removed from ice water bath, the gloves are removed from the hands or feet and patted dry. Digital temperatures, PPG or PVR waveforms and digital blood pressures are recorded immediately and at specified recorded intervals until temperatures or blood pressures return to baseline results or some definitive endpoint. In some instances where vasospasm is severe, the temperature may be reduced initially, and the return to normal temperature level for each patient must be documented prior to the end of the study.

- 3.3 For follow-up studies, reviews previous vascular technology studies so that the current study 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 Reviews data acquired during the Segmental Pressures, Doppler Waveform and Cold Stress Examination to ensure that a complete and comprehensive evaluation has been performed and documented.
- 4.2 Explains and documents any exceptions to the routine Segmental Pressures, Doppler Waveform and Cold Stress Examination protocol (i.e., study limitations, omissions or revisions).
- 4.3 Records all technical findings required to complete the final diagnosis on a worksheet so that the measurements can be classified according to the laboratory diagnostic criteria (these criteria may be based on published or internally validated data) (see appendix).
- 4.4 Documents the exam date, clinical indication(s), technologist performing the exam and a summary of the exam results in a vascular laboratory logbook.
- 4.5 Alerts physician when immediate medical attention is indicated based on the Segmental Pressures, Doppler Waveform and Cold Stress Examination findings.

#### **GUIDELINE 5: PRESENTATION OF EXAM FINDINGS**

- 5.1 Provides preliminary results when necessary as provided for by internal guidelines based on the Segmental Pressures, Doppler Waveform and Cold Stress Examination findings.
- 5.2 Presents record of all data, explanations, and technical worksheet to the interpreting physician for use in rendering a final diagnosis and for archival purposes.

#### **GUIDELINE 6: EXAM TIME RECOMMENDATIONS**

High quality and accurate results are fundamental elements of the Segmental Pressure, Doppler Waveform and Cold Stress Examination. 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); and, post-exam procedures: cleanup; compiling, processing, reviewing exam data for preliminary and/or formal interpretation (Guidelines 3 and 4); patient communication (Guideline 2); exam charge and billing activities. Recommended time allotment is 25 minutes.
- 6.2 Direct exam components includes equipment optimization and the actual hands-on, examination process (Guideline 2). Recommended time allotment is 60 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 must keep current with:

- 7.1 Advances in diagnosis and treatment of peripheral arterial and Raynaud's diseases
- 7.2 Changes in peripheral arterial and cold stress evaluation protocols or published laboratory diagnostic criteria
- 7.3 Advances in ultrasound technology used for the peripheral arterial and/or cold stress evaluation
- 7.4 Advances in other technology used for the peripheral arterial and/or cold stress 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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