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VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Extracranial Cerebrovascular Duplex Ultrasound Evaluation

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Society for Vascular Ultrasound
4601 Presidents Drive, Suite 260
Lanham, MD 20706-4831
Tel.: 301-459-7550
Fax: 301-459-5651
E-mail: svuinfo@svunet.org
Internet: www.svunet.org

Extracranial Cerebrovascular Duplex Ultrasound Evaluation

PURPOSE

Extracranial cerebrovascular evaluations are performed to assess the cervical carotid (common, internal, and external) and vertebral arteries to determine the hemodynamic status of these vessels and to detect the presence of pathology.

COMMON INDICATIONS

Common indications for performance of this examination include, but are not limited to:

- Transient ischemic attacks
- Amaurosis fugax
- Carotid bruit
- Stroke (Cerebrovascular Accident {CVA})
- Follow-up of known carotid stenosis
- Post intervention follow-up (carotid endarterectomy, stent, etc)
- Trauma in the distribution of the carotid artery

CONTRAINDICATIONS AND LIMITATIONS

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

- Patients with short, thick, muscular necks
- Patients who have had recent surgery (penetration and visualization may be limited secondary to the presence of edema, hematoma, surgical staples, dressings)
- Calcified plaque and shadowing may limit penetration of the ultrasound beam, limiting the Doppler and B-mode image assessment
- Patients with chronic obstructive pulmonary disease (COPD) and arthritic necks may not be able to lie flat (however, they would tolerate scanning while sitting in a chair or with the head of the bed elevated)
- Patients who are unable to cooperate with the evaluation due to mental status changes (dementia, Alzheimer's, mental retardation, etc) and involuntary movement
- Studies performed at the bedside may be limited due to limited access to the patient due to machinery and room dimensions.

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, 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.
- 1.3 Respond to questions and concerns about any aspect of the evaluation.
- 1.4 Educate patient about risk factors for and symptoms of stroke and TIA.
- 1.5 Refer specific diagnostic, treatment or prognosis questions to the patient's physician.
- 1.6 The patient's head and neck should be positioned in such a manner that allows the sonographer maximum access to the vessels being examined. In some instances, due to the immobility of the patient, the sonographer may elect to examine the patient sitting in a chair.

GUIDELINE 2: PATIENT ASSESSMENT

Patient assessment must be completed before the evaluation is performed. It 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, 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:
 - a. Current medical status.
 - b. Previous vascular/cardiovascular surgeries.
 - c. Current medications or therapies.
 - d. Presence of any risk factors for cerebrovascular disease: diabetes; hypertension; peripheral vascular disease; coronary artery disease; family history of cerebrovascular, coronary artery, or vascular disease; family history of diabetes or hypertension; age; smoking.
 - e. Presence of any symptoms for cerebrovascular disease: aphasia; dysphasia; visual disturbances; numbness, weakness or paralysis of extremities.
 - f. Results of other relevant diagnostic procedures.
- 2.2 Obtain bilateral brachial artery blood pressures.
- 2.3 When indicated, perform adjunctive procedures: such as auscultation of bruits (carotid, orbital, and subclavian) palpation of pulses (brachial, radial, carotid, facial).
- 2.4 Verify that the requested procedure correlates with the patient's clinical presentation.

GUIDELINE 3: EXAMINATION GUIDELINES

Throughout the examination, sonographic characteristics of normal and abnormal tissues, structures, and blood flow are 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 status during the procedure. Sonographic 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 duplex instrumentation with appropriate frequencies for the vessels being examined. This includes display of both two-dimensional structure and motion in real-time and Doppler ultrasonic signal documentation with:
 - a. Spectral analysis; color and/or power Doppler imaging
 - b. Videotape, film or digital storage of static images and/or digital clips (cine-loop)
- 3.2 Follow a standard exam protocol for each study. Bilateral evaluations are essential for a complete evaluation; however, post-operative studies can be unilateral based on internal laboratory algorithms. The standard exam includes B-mode imaging of all accessible portions of the entire common carotid artery (CCA), carotid bifurcation, internal carotid (ICA) and external carotid artery (ECA).

The ICA should be followed from its origin to its most distal accessible extracranial segment. The vertebral artery is identified for determination of flow direction. It is recommended that the subclavian artery be evaluated in the presence of brachial artery pressure asymmetry > 20 mmHg and/or flow characteristic changes (mid-systolic deceleration or to-fro flow) or reversal in the vertebral artery.

All minimum of two views are obtained to show anterior, lateral, or posterior-lateral sagittal views and transverse imaging planes as needed to penetrate area of interest. B-Mode data interpretation should attempt to classify echo characteristics of plaque as homogeneous (uniform echo pattern) or heterogeneous (complex pattern with mixed echo densities and/or sonolucent areas) and to describe surface characteristics, e.g. smooth, irregular. If pathology is identified, the plaque appearance, location, and extent should be documented, whenever possible. Residual lumen may be measured, and if so should be done on a transverse view for accuracy. At times, a sagittal view is possible and comparison of smallest lumen to more distal normal lumen can be obtained.

- 3.3 Doppler spectral analysis is performed in the sagittal plane. In an effort to promote consistency, velocity measurements should be taken at an angle of 60° or less (if a 60 degree angle cannot be maintained) with the cursor aligned parallel to vessel walls. Labs should clearly specify in the text if angle correction of the Doppler cursor is aligned to color Doppler flow signatures. To ensure complete interrogation, precisely track the spectral Doppler cursor throughout the entire common and internal carotid arteries. At least one representative spectral waveform is recorded proximally and distally in the common carotid artery. Individual laboratory protocols may require additional sampling in the common carotid artery, Doppler samples of the proximal, mid and distal Internal carotid artery should be documented. Spectral measurements should include peak systolic (PSV) and end diastolic velocity (EDV) in the sampled areas. If an ICA/CCA ratio is obtained, an unobstructed segment of the distal common carotid artery, approximately 2cms proximal to the flow divider, is the recommended reference point. In the presence of pathology, spectral waveforms should be recorded proximal, within, and distal to the lesion. Post stenotic turbulence should be documented, if present. A spectral waveform is recorded from the proximal external carotid artery. Representative color Doppler image is recorded per individual laboratory protocol. The vertebral artery is evaluated with spectral analysis recorded as described in 3.2 above.

- 3.4 To determine any change in follow-up studies, review previous examinations so that the current evaluation duplicates prior imaging and Doppler parameters. The examination protocol may need to be modified to address current needs.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC 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 examination 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. Physician signature must appear on the final report

GUIDELINE 5: PRESENTATION OF EXAM FINDINGS

The technologist/sonographer/examiner should:

- 5.1 Provide preliminary results when necessary as per internal laboratory guidelines.
- 5.2 Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician for use in rendering a diagnosis and for archival purposes.
- 5.3 Alert vascular laboratory Medical Director or appropriate health care provider when immediate medical attention is indicated based on the examination findings.

GUIDELINE 6: EXAM TIME RECOMMENDATIONS

High quality, accurate results are fundamental elements of extracranial cerebrovascular examination. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy. Total recommended time allotment is 65 minutes.

- 6.1 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 (Guideline 1); 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 includes equipment optimization and the actual hands-on, examination process (Guideline 3). Recommended time allotment is 30-40 minutes (for bilateral examination).

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 from either ARDMS (RVT credential) or CCI (RVS credential), or the radiologic credential (RT-VS), the individual must keep current with:

- Advances in diagnosis and treatment of cerebrovascular disease.
- Changes in extracranial cerebrovascular evaluation protocols or published laboratory diagnostic criteria.
- Advances in ultrasound technology used for the extracranial cerebrovascular evaluations.
- Advances in other technology used for the Extracranial Cerebrovascular Evaluations.

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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