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**VASCULAR TECHNOLOGY  
PROFESSIONAL PERFORMANCE GUIDELINES**

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# Extracranial Cerebrovascular Duplex Ultrasound

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## **PURPOSE**

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

## **APPROPRIATE INDICATIONS**

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

- Symptoms of cerebrovascular accident (CVA)
- Symptoms of transient ischemic attack (TIA)
- Carotid or cervical bruit
- Follow-up of known carotid artery stenosis
- Preoperative evaluation prior to major surgical procedures
- Post-intervention follow-up (carotid endarterectomy, stent, etc.)
- Trauma in the distribution of the carotid artery
- Amaurosis fugax
- Pulsatile neck mass
- Syncopal episodes
- Suspected subclavian steal syndrome

## **CONTRAINDICATIONS AND LIMITATIONS**

Contraindications and limitations may include the following:

- Neck Braces
- Endotracheal tube harness
- Patients with short, thick, muscular necks
- Recent surgery in region of exam (penetration and visualization may be limited secondary to the presence of edema, hematoma, surgical staples, dressings)
- Calcified/complex plaque and acoustic shadowing may limit penetration of the ultrasound beam, limiting the Doppler and B-mode image assessment
- Patients with chronic obstructive pulmonary disease (COPD) or arthritic necks may require head of the bed elevation or sit upright during exam
- Involuntary movement or inability to remain still during examination
- Studies performed at the bedside may be limited due to patient access and room dimensions

## **PATIENT COMMUNICATION**

Prior to beginning the exam, the sonographer or examiner should:

- Introduce self and explain why the examination is being performed and indicate how much time the examination will take.
- Verify the patient's name and date of birth or utilize facility-specific patient

identifiers.

- 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 understood.
- Respond to questions and concerns about any aspect of the evaluation.
- Educate patient about risk factors for and symptoms of stroke and TIA.
- Refer specific diagnostic, treatment or prognosis questions to the patient's physician.

## **PATIENT ASSESSMENT**

A patient assessment should be completed before the evaluation is performed. This includes an assessment of the patient's ability to tolerate the procedure and an evaluation of any contraindications to the procedure. The sonographer or examiner should 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:

- Previous cardiovascular surgeries
- Current medications or therapies
- Presence of risk factors for cerebrovascular disease
- Presence of symptoms for cerebrovascular disease
- Results of other relevant diagnostic procedures
- Review of prior examinations to ensure that the evaluation duplicates prior imaging and Doppler parameters.
- Verify that the requested procedure correlates with the patient's clinical presentation

## **PATIENT POSITIONING**

The patient's head and neck should be positioned in such a manner that allows the examiner maximum access to the vessels being interrogated:

- Patient in supine position with head slightly elevated for comfort
- Head slightly rotated towards the contralateral side to be examined

## **INSTRUMENTATION**

Use appropriate duplex instrumentation with appropriate frequencies for the vessels being examined:

- Typically, this is a linear 5-7 MHz transducer
  - Superficial structures may require a higher frequency transducer
  - Deeper structures or edematous tissue may require a lower frequency transducer
- Display of two-dimensional structures and motion in real-time
  - Doppler ultrasonic signal documentation
  - Spectral analysis with color and/or power Doppler imaging

- Digital storage capabilities of ultrasound images

## EXAM PROTOCOL

Sonographers should follow a standard imaging protocol. A complete evaluation includes B-mode imaging, spectral Doppler analysis, and color Doppler imaging of all accessible portions of the extracranial carotid arteries. Bilateral evaluations are essential for a complete evaluation; however, post-operative studies may be unilateral based on laboratory-specific protocols.

Throughout each examination, the sonographer or examiner should:

- Observe sonographic characteristics of normal and abnormal tissues, structures, and blood flow, allowing necessary adjustments to optimize exam quality.
- Assess and monitor the patient's physical and mental status, allowing modifications to the procedure plan according to the patient's clinical status.
- Analyze sonographic findings to ensure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.
- Accurately annotate B-mode, color and spectral Doppler images.

B-mode imaging of the extracranial carotid arteries should be performed in longitudinal and transverse planes utilizing anterior, lateral and posterior-lateral probe positions. Optimize the gain to depict vessel walls, plaque and any other abnormalities.

- **B-mode images** should include the following:
  - Longitudinal image of the common carotid artery (CCA)
  - Transverse image of the carotid artery bifurcation
  - Longitudinal image of the internal carotid artery (ICA)
  - Longitudinal image of the external carotid artery (ECA)
    - The location, severity and characteristics of plaque should be documented in transverse and longitudinal planes.
    - Any other abnormalities should be documented.
  - When present, carotid artery stent including proximal and distal ends.

Color Doppler may be used to depict areas of abnormal flow or significant stenosis. Power Doppler is useful to confirm areas of possible vessel occlusion or low flow states.

- **Color Doppler images** may include the following:
  - Longitudinal image of the CCA
  - Transverse image of the carotid artery bifurcation
  - Longitudinal image of the ICA
  - Longitudinal image of the ECA
  - Longitudinal image of the vertebral artery

Velocity measurements should be obtained from a longitudinal plane at an angle of 60° parallel to the direction of the blood flow/vessel walls. Maintain a Doppler angle between 45° and 60° whenever possible. Angles greater than 60° must be avoided. Doppler angles less than 45° may be necessary due to patient anatomy. To obtain peak velocity, utilize color Doppler to note areas of concern and “walk” the spectral Doppler cursor throughout these areas. Post stenotic turbulence should be documented when present.

- **Spectral Doppler images** should include the following:
  - Proximal CCA
  - Mid to distal CCA
  - Proximal ICA
  - Distal ICA
  - Proximal ECA
  - Vertebral artery
  - Subclavian artery (when appropriate)
    - Typically evaluated in the presence of brachial artery pressure asymmetry, greater than 10 - 20mmHg, and/or flow characteristic changes or flow reversal in the vertebral artery
- In the presence of pathology, spectral waveforms should be recorded proximal to, within, and distal to the lesion.
- Documentation of sites of vascular intervention (i.e., endarterectomy) should include representative waveforms and velocity measurements proximal to the intervention site, within the intervention site, and distal to the intervention site. In the presence of stents, documentation should include:
  - Native artery at the proximal end of the stent
  - Proximal, mid and distal stent
  - Native artery at the distal end of the stent
- Any other abnormalities should be documented.

## REVIEW OF DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review data acquired during the extracranial cerebrovascular duplex ultrasound exam to ensure that a complete and comprehensive evaluation has been performed and documented.
- Explain and document any exceptions or limitations to the protocol (i.e., study omissions or revisions).
- Determine any change in follow-up studies by reviewing previous exam documentation so that the current evaluation can document any change in status and duplicate prior imaging and Doppler parameters.
- Record the technical findings required to complete the final diagnosis on a

worksheet or other appropriate method (e.g., computer software), so that the findings can be classified according to the laboratory diagnostic criteria.

- Document the exam date, clinical indications, sonographer performing the evaluation, and exam summary in the patient's medical record.

## PRESENTATION OF EXAM FINDINGS

The sonographer or examiner should:

- Provide preliminary results when necessary as provided for by laboratory specific guidelines.
- Present the record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician. Interpretation must be available within two business days.
- The sonographer's and interpreting physician's name must appear on the final report. The finalized/signed report should be available within four business days.
- Alert the vascular laboratory medical director or appropriate healthcare provider when immediate medical attention is indicated based on departmental guidelines and procedures.

## EXAM TIME RECOMMENDATIONS

High-quality and accurate results are fundamental elements of the extracranial cerebrovascular examination. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy.

- 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, patient communication.
  - Post-exam activities: exam room cleanup, compiling and processing exam data for preliminary and/or formal interpretation, and exam billing activities.
- Direct exam components include:
  - Equipment optimization and the actual hands-on, examination process.
- While study times may vary depending on testing protocols, patient condition, and clinical complexity of the evaluation being performed, these are the times necessary to provide a quality diagnostic evaluation. Listed are the recommended examination times for performing each CPT related to this guideline, which were derived from the direct time inputs from the Resource Based Relative Value Scale (RBRVS).
  - 93880            67 minutes
  - 93882            46 minutes

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