



**VASCULAR TECHNOLOGY
PROFESSIONAL PERFORMANCE GUIDELINES**

Extracranial Cerebrovascular Duplex Ultrasound

This Guideline was prepared by the Professional Guidelines Subcommittee of the Society for Vascular Ultrasound (SVU) as a template to aid the vascular technologist/sonographer and other interested parties. It implies a consensus of those substantially concerned with its scope and provisions. The guidelines contain recommendations only and should not be used as a sole basis to make medical practice decisions. This SVU Guideline may be revised or withdrawn at any time. The procedures of SVU require that action be taken to reaffirm, revise, or withdraw this Guideline no later than three years from the date of publication. Suggestions for improvement of this Guideline are welcome and should be sent to the Executive Director of the Society for Vascular Ultrasound. No part of this Guideline may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Sponsored and published by:
Society for Vascular Ultrasound
1601 Utica Ave S., Suite 213 Minneapolis, MN
55416
Tel.: 651-288-3431
Fax: 651-290-2266
E-mail: svuinfo@svunet.org
Internet: www.svunet.org

Copyright © by the Society for Vascular Ultrasound, 2026.
ALL RIGHTS RESERVED. PRINTED IN THE UNITED STATES OF AMERICA.
VASCULAR PROFESSIONAL PERFORMANCE GUIDELINE

Updated April 2026

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 evaluation of patients with:

- Hemispheric neurologic symptoms including stroke, transient ischemic attack and amaurosis fugax
- Non-hemispheric or unexplained neurologic symptoms (syncope, seizures, or dizziness)
- Carotid or other cervical bruit
- Known or documented carotid artery stenosis

Trauma in the distribution of the carotid artery (suspected carotid artery dissection, arteriovenous fistula, or pseudoaneurysm)

- Pulsatile neck masses
- Syncopal episodes
- Suspected subclavian steal syndrome
- Hollenhorst plaque visualized on retinal examination

This exam may also be conducted:

- Prior to major cardiovascular surgical procedures
- Following cerebrovascular revascularization, including carotid endarterectomy, stenting, or carotid to subclavian artery bypass graft
- For intra-operative monitoring
- For Screening high-risk patients, including atherosclerosis elsewhere, history of head and neck radiation, known fibromuscular dysplasia, Takayasu arteritis, or other vasculopathy in another circulation

CONTRAINDICATIONS AND LIMITATIONS

Although there are no absolute contraindications, 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 grayscale 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 technologist/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 technologist/sonographer should obtain a complete, pertinent history by interviewing the patient or patient's representative and reviewing 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 to allow the examiner maximum access to the vessels being interrogated:

- Patient in supine position with head slightly elevated for comfort
- Head slightly rotated contralateral to the side being 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 capability of ultrasound images is recommended and may be required per institutional guidelines.

EXAM PROTOCOL

The technologist/sonographer should follow a standard imaging protocol. A complete evaluation includes grayscale imaging, spectral Doppler analysis, and color Doppler imaging of all accessible portions of the extracranial carotid arteries. Bilateral evaluations are the standard for a complete evaluation; however, studies may be unilateral as appropriate, based on laboratory-specific protocols, contraindications or other limitations.

Throughout each examination, the technologist/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 grayscale, color and spectral Doppler images.

Grayscale 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.

- **Grayscale 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 for evaluation of stent apposition to the artery wall and rest of stent for uniform deployment.

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 with the transducer aligned sagittal to the long axis of the vessel using an angle $\leq 60^\circ$ parallel to the direction of the blood flow or the vessel walls per laboratory protocol. Angles greater than 60° must be avoided. Doppler angles less than 45° may be necessary due to vessel anatomy. To elicit the highest velocity within a suspected stenosis, utilize color Doppler to note areas of concern and “walk” the spectral Doppler cursor throughout these areas to profile the lesion. Post-stenotic turbulence should be documented when present to confirm stenosis.

- **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 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, within, 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 technologist/sonographer should:

- Review data acquired during the extracranial cerebrovascular duplex ultrasound exam to ensure that an appropriately complete evaluation has been performed and documented.
- Explain and document any exceptions or limitations to the lab protocol (i.e., study omissions or revisions).

- Review previous exam images and documentation to duplicate prior imaging and Doppler parameters so that the current evaluation can document any change in status.
- On a worksheet or by use of some other appropriate method (e.g., computer software), record the technical findings that are required to render the final diagnosis and report.
- Document the exam date, clinical indications, technologist/sonographer who performed the evaluation, and an exam summary in the patient's medical record.

PRESENTATION OF EXAM FINDINGS

The technologist/sonographer should:

- Provide preliminary results, when necessary, as determined by laboratory specific guidelines.
- Present the record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician. A preliminary report of findings must be available within two business days.
- Assure that the technologist/sonographer's and interpreting physician's name appear on the final report. A final 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, physical examination, 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, listed below are the recommended examination times for performing each CPT related to this guideline. These were derived from the direct time inputs from the Resource Based Relative Value Scale (RBRVS).
 - 93880 67 minutes
 - 93882 46 minutes

REFERENCES

1. Grant EG, Benson CB, Moneta GL, et al. Carotid artery stenosis: gray-scale and Doppler US diagnosis—Society of Radiologists in Ultrasound Consensus Conference. *Radiology* 2003; **229**: 340–346.
2. Kim ES, Thompson M, Nacion KM, Celestin C, Perez A, Gornik HL. Radiologic importance of a high-resistive vertebral artery Doppler waveform on carotid duplex ultrasonography. *J Ultrasound Med* 2010; **29**: 1161–1165.
3. Slovut DP, Romero JM, Hannon KM, Dick J, Jaff MR. Detection of common carotid artery stenosis using duplex ultrasonography: a validation study with computed tomographic angiography. *J Vasc Surg* 2010; **51**: 65–70.
4. Fleming SE, Bluth EI, Milburn J. Role of sonography in the evaluation of carotid artery stents. *J Clin Ultrasound* 2005; **33**: 321–328.
5. Stanziale SF, Wholey MH, Boules TN, Selzer F, Makaroun MS. Determining in-stent stenosis of carotid arteries by duplex ultrasound criteria. *J Endovasc Ther* 2005; **12**: 346–353.
6. Zhou W, Felkai DD, Evans M, et al. Ultrasound criteria for severe in-stent restenosis following carotid artery stenting. *J Vasc Surg* 2008; **47**: 74–80.
7. Choi HY. Carotid duplex ultrasound: interpretations and clinical applications. *Ann Clin Neurophysiol*. 2021;23(2):82-91.
8. Lee W. General principles of carotid Doppler ultrasonography. *Ultrasonography*. 2014;33(1):11-17.
9. Polak JF, Alessi-Chinetti JM, Kremkau FW. Doppler velocity estimates of internal carotid artery stenosis: angle correction parallel to the color Doppler Lumen versus parallel to the artery wall. *J Ultrasound Med* 2019;38:3211-3218.
10. Zierler RE, Jordan WD, Lal BK, Mussa F, Leers S, Fulton J, et al. The Society for Vascular Surgery practice guidelines on follow-up after vascular surgery arterial procedures. *J Vasc Surg* 2018;68:256-284.
11. Bandyk DF. Follow-up after carotid endarterectomy and stenting: What to look for and why. *Semin Vasc Surg* 2020;33:47-53.
12. Moneta GL, Mitchell EL, Esmonde N, Rumwell C, Primozich JF. Extracranial Carotid and Vertebral Arteries. In: Strandness's Duplex Scanning in Vascular Disorders. 4th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2009: pages 87-100.

13. Gerhard-Herman, Gardin JM, Jaff M, et al. Guidelines for noninvasive vascular laboratory testing: a report from the American Society of Echocardiography and the Society of Vascular Medicine and Biology. J Am Soc Echocardiography. 2006; 11(8): 955-972. DOI:10.1177/1358863x06070516
14. IAC Standards and Guidelines for Vascular Testing. Intersocietal Accreditation Commission Web Site. Retrieved from <https://www.intersocietal.org/vascular/standards/IACVascularTestingStandards2018.pdf>