



VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Lower Extremity Venous Duplex Evaluation for Insufficiency

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VASCULAR PROFESSIONAL PERFORMANCE GUIDELINE

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PURPOSE

To evaluate the deep and superficial venous systems, including perforators, for evidence of valvular incompetence, obstruction and characterize venous hemodynamics relevant to clinical management

APPROPRIATE INDICATIONS

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

- Stasis dermatitis or skin pigmentation of presumed venous origin
- Venous stasis ulcers
- Recurrent swelling of the lower extremity
- Lower extremity pain or other discomfort (e.g., aching, heaviness, fatigue, soreness, burning)
- Visible varicose veins (generally, ≥ 3 mm in diameter)
- Venous claudication
- Skin pigmentation (presumes venous origin) does not include focal pigmentation over varicose veins or pigmentation due to other chronic diseases (e.g., vasculitis purpura)
- Stasis dermatitis
- Inflammation
- Induration includes atrophe, blanche and lipodermatosclerosis (presumes venous origin of secondary skin and subcutaneous changes, e.g. chronic edema with fibrosis, hyper- dermatitis).
- Pain and edema of the lower extremities
- Preoperative evaluation for venous insufficiency
- Assessment of suspected recurrent or residual venous insufficiency

CONTRAINDICATIONS AND LIMITATIONS

Contraindications and limitations may include the following:

- Obesity or body habitus limiting visualization
- Severe pain, edema, or open wounds limiting compression
- Inability to tolerate upright or dependent positioning

PATIENT COMMUNICATION

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

- Introduce themselves and explain the purpose and duration of the examination
- Verify the patient identity using appropriate identifiers
- Explain the procedure in terms appropriate to the patient's understanding
- Address questions and concerns
- Educate the patient about risk factors for and symptoms of lower extremity venous insufficiency.
- Refer diagnostic or treatment-related questions to the appropriate provider

PATIENT ASSESSMENT

A patient assessment should be completed before the evaluation is performed. This

includes assessment of the patient's ability to tolerate the procedure and evaluation of any contraindications to the procedure. The sonographer or examiner 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:

- Prior deep vein (DVT) or superficial thrombus (SVT).
- Prior venous interventions (ablation, sclerotherapy, stripping, stenting)
- Symptoms and duration
- Risk factors (family history, trauma, immobility)
- Cardiac history (e.g., CHF, CABG), vein harvest
- Current medications or therapies
- History of venous ulcers and/or varicosities
- Results of other relevant diagnostic procedures

Complete a limited physical exam which includes observation and localization of the presence of any signs or symptoms of peripheral venous disease, including:

- Distribution of varicosities
- Skin changes
- Edema Ulceration Areas of tenderness
- Verify that the requested procedure correlates with the patient's clinical presentation
- Identify patterns of veins along the medial, lateral and posterior lower extremity (helps to identify source of varicose veins, spider veins, accessory saphenous veins and/or perforators).

PATIENT POSITIONING

The optimal positioning for viewing the veins of the lower extremity is:

- Supine position with the head of the bed elevated
 - For assessing reflux: standing, sitting and/or reverse Trendelenburg (at least 15 degrees) is used to maintain lower extremity dependency.
- Leg being examined, externally rotated
- Prone or lateral decubitus may be used for posterior structures

INSTRUMENTATION

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

- Linear transducer (typically 5-18 MHz) for superficial structures (5-18 MHz)
 - Lower frequency transducers for deeper structures
 - Lower frequencies within this range may be necessary for deeper veins or in patients with increased tissue depth or edema
 - Transducer selection should be adjusted throughout the examination to ensure optimal visualization of target vessels
- Grayscale
- Color or power Doppler
- Spectral Doppler
- Digital storage capabilities of ultrasound

image Other non-imaging equipment:

- The use of a rapid cuff inflator can be used in place of manual augmentation.

EXAM PROTOCOL

A complete venous insufficiency evaluation includes:

- Assessment of compressibility
- Evaluation of obstruction or thrombus
- Spectral Doppler waveform analysis
- Assessment of venous reflux
- Identification of reflux source and pathway

Examinations may be performed unilaterally when guided by an appropriate diagnostic algorithm. However, in such cases, comparison of the common femoral vein spectral Doppler waveform with the contralateral limb is required

Evaluation of the common femoral vein waveform should assess:

- Spontaneity
- Respiratory phasicity
- Pulsatility
- Symmetry between limbs
- Waveform characteristics

Compression Technique

- Serial transverse compressions should be performed ≤ 2 cm intervals, when anatomically feasible
- Document compressibility and intraluminal findings

Provocative Maneuvers for Reflux Assessment

General Principles

Venous reflux assessment should be performed using techniques that allow physiological and segmental evaluation of flow.

Recommended Techniques

- Rapid cuff inflators may be used to provide standardized augmentation and reproducible reflux measurements
- Manual distal augmentation is recommended for targeted, segmental assessment of reflux pathways and complex hemodynamics
- Valsalva maneuver may be used for proximal veins (e.g, CFV, SFJ)

Additional Considerations for Complex Hemodynamics

In cases of complex venous disease, including multiple perforators, inter-saphenous connections, or atypical flow patterns, additional maneuvers may be utilized to further characterize venous hemodynamics.

Proximal augmentation (manual compression) may be used as an adjunctive technique to:

- *Temporarily modify venous outflow*
- *Evaluate redistribution of flow between venous segments*

- Clarify competing reflux pathways

This technique should be applied with caution, as excessive or improperly timed compression may artificially induce retrograde flow.

When proximal compression is utilized, interpretation should emphasize physiologic flow patterns rather than isolated responses to compression.

For accurate reflux assessment, it is recommended that:

- Reflux is confirmed following a complete physiologic sequence of flow
- This includes observation of:
 - Initial retrograde flow
 - Restoration of antegrade flow
 - Recurrent retrograde flow following release or subsequent augmentation

Reflux measurements should be based on sustained retrograde flow independent of direct compression effects.

Correlation with distal augmentation findings is recommended to confirm physiologic significance.

Hemodynamic Assessment of Reflux

Venous reflux should be evaluated as part of an interconnected venous system.

The examiner should identify:

- Source of reflux (e.g, SFJ, SPJ, perforator, deep system)
- Direction of flow
- Pathway of reflux propagation
- Communication between venous systems
- Termination of reflux (e.g, varicosities, perforators, deep veins)

Reflux Definition

Reflux is defined as retrograde flow exceeding:

- ≤500 milliseconds in superficial veins
- ≤1000 milliseconds in deep veins
- ≤500 milliseconds in in perforating veins

Direct Testing: Duplex Evaluation for Venous Reflux

Interrogation and documentation of **compression** of the following deep veins is the minimum requirement:

- Common femoral
- Proximal deep femoral
- Sapheno-femoral junction (SFJ)
- Femoral vein (proximal, mid distal)
- Popliteal
- Posterior tibial
- Peroneal
- Gastrocnemius veins

- Soleal veins (when visualized)

Inclusion of the gastrocnemius and soleal veins is required, as muscular vein thrombosis accounts for a substantial proportion of lower extremity DVT and may be missed if not specifically evaluated.

Superficial Venous System (minimum required)

- Great saphenous (GSV)
- Small saphenous (SSV)
- Saphenofemoral junction (SFJ)
- Saphenopopliteal junction (SPJ)
- Anterior saphenous vein (ASV)
- Posterior accessory of the great saphenous vein (PAGSV) if present
- Additional images to document areas of suspected thrombosis

Additional Evaluation (as indicated)

- Varicosities
- Perforating veins
- Iliac veins / inferior vena cava

Perforating Veins

Evaluation of perforating veins is recommended, particularly when:

- Reflux is not explained by truncal incompetence
- Inter-saphenous flow is identified
- Planning treatment with non-thermal techniques
- An active or healing venous ulcer is present, especially in the region of the ulcer

In patients with active or recently healed venous ulcers, targeted evaluation of perforators in the area of skin breakdown is important to identify potential sources of pathologic reflux contributing to ulcer formation or delayed healing.

Perforators should be documented when:

- Diameter ≥ 3.5 mm
- Reflux ≥ 500 ms
- Flow direction is deep $\rightarrow$ superficial

Identification of clinically significant perforators may be important for treatment planning, including ultrasound-guided sclerotherapy and microfoam therapies.

Measurements

Measurements should be obtained with the limb in a dependent position:

- GSV at SFJ

- GSV in the proximal thigh
- GSV at the knee
- SSV at SPJ (or anatomic equivalent)
- SSV at proximal calf
- SSV at mid-calf
- SSV extension if present
- Anterior saphenous vein and posterior accessory of the great saphenous vein when present
- Perforators (when clinically relevant, particularly those ≥ 3.5 mm or associated with reflux)
- Above the knee, below the knee and lateral varicosities when present

Measurements should be:

- Consistent (per laboratory protocol)
- Obtained without external compression

“Vein diameter measurements should be obtained in the transverse plane with calipers placed from the anterior wall to the posterior wall. Measurements should be performed consistently according to laboratory protocol. Measurement from outer wall to outer wall is recommended to ensure accurate representation of total vessel diameter and to minimize underestimation related to venous compressibility.”

Spectral Doppler Evaluation

- Performed in longitudinal plane
- Angle correction is not required unless measuring velocities
- Reflux duration should be measured and documented

Minimal spectral Doppler documentation includes:

- Common femoral vein (bilaterally)
- SFJ (ostium, terminal and pre-terminal valves)
- Femoral vein (mid)
- Popliteal
- GSV (above and below the knee)
- SPJ / SSV
- SSV posterior extension if present
- Anterior and Saphenous veins if present

Additional spectral Doppler evaluation should be obtained when clinically indicated, including:

- Perforating veins demonstrating suspected reflux
- Inter-saphenous connections or atypical reflux pathways
- Varicosities (above the knee or below the knee) when present and clinically relevant
- Additional measurements may include GSV in proximal, mid and distal-calf, SSV in the distal calf

- Areas of clinical concern or symptom correlation

Not all tributaries or varicosities require individual spectral Doppler interrogation. When multiple pathways are present, representative sampling of hemodynamically significant vessels is sufficient to characterize reflux patterns. Reflux duration should be measured and documented at representative sites of incompetence.

Thrombus Evaluation

When pathology (thrombus or intraluminal echoes) is present:

- Document compressibility using grayscale
- Vessel diameter changes
- Differentiate between partially or totally non-compressible segments
- Appearance, presence of intraluminal echoes (echogenicity)
- Attachment vs free-floating components
- Document location, extent and echogenicity of thrombus

REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review of prior studies when available
- Ensure completeness of the study
- Document limitations
- Compare with prior studies when available
- Record findings for interpretation
- 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 internal guidelines based on the lower extremity venous insufficiency evaluation findings.
- Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician for use in interpretation.
- Interpreting physician's name, date of exam, date of interpretation, and an appropriate indication must appear on the final report.
- Alert the vascular laboratory Medical Director or appropriate health care provider when immediate medical attention is indicated based on the departmental guideline/policies and procedures.

EXAM TIME RECOMMENDATIONS

High quality, accurate results are fundamental elements of the lower extremity venous insufficiency evaluation. 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).
 - CPT 93970 70 minutes
 - CPT 93971 45 minutes

Time should allow for:

- Comprehensive evaluation
- Hemodynamic assessment
- Accurate documentation

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