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VASCULAR TECHNOLOGY PROFESSIONAL PERFORMANCE GUIDELINES

Lower Extremity Venous Insufficiency Evaluation

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Lower Extremity Venous Insufficiency Evaluation

PURPOSE

To evaluate the deep and superficial venous systems, including perforators, for evidence of valvular incompetence and obstruction.

APPROPRIATE INDICATIONS

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

- Stasis dermatitis or pigmentation
- Venous stasis ulcers
- Recurrent swelling of the lower calf and ankle
- 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 white atrophy and lipodermatosclerosis (presumes venous origin of secondary skin and subcutaneous changes, e.g. chronic edema with fibrosis, hyperdermitis).
- Pain and edema of the lower extremities
- Preoperative evaluation for venous insufficiency

CONTRAINdicATIONS AND LIMITATIONS

Contraindications and limitations may include the following:

- Obesity
- Open draining ulcers
- Severe edema and/or pain of the lower extremity
- Inability to stand for extended periods of time

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' 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 clearly understood.
- Respond to questions and concerns about any aspect of the evaluation.
- Educate patient about risk factors for and symptoms of lower extremity venous insufficiency.
- 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 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 interview of the patient or patient's representative and review of the patient's medical record, if available. A pertinent history includes:

- Risk factors for lower extremity venous insufficiency, previous deep vein and/or superficial vein thrombosis (DVT/SVT)
- Current medications or therapies
- Family history of venous thrombosis
- Lower extremity trauma
- History of venous ulcers and/or varicosities
- History of previous vein surgeries or interventions
- Venous ablation procedures
- Venous stripping
- Vein harvest
- Iliac vein stenting for iliac vein compression (May-Thurner Syndrome)
- Sclerotherapy
- Congestive heart failure (CHF) or other similar cardiac history
- Current medications and/or therapies
- 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:

- Swelling
- Pain/tenderness
- Palpable cord
- Discoloration
- Varicosities
- Ulceration
- Verify that the requested procedure correlates with the patient's clinical presentation
- 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
- Alternately, the lateral decubitus or prone position may be utilized to visualize the popliteal vein, peroneal and proximal posterior tibial veins, small saphenous vein and soleal veins.

INSTRUMENTATION

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

- Typically a linear 5-7 MHz transducer
 - Superficial structures may require higher frequency
 - Deeper structures or edematous tissue may require a lower frequency transducer
 - Iliocaval imaging will require lower frequency 2-5 MHz curved linear or phased array transducers.
- Display of two-dimensional structure and motion in real-time
 - Doppler ultrasonic signal documentation
 - Spectral analysis with color and/or power Doppler imaging
- 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

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.

Follow a standard imaging protocol per department specific/facility specific anatomic algorithm. A complete venous insufficiency evaluation incorporates B-mode and spectral Doppler with color and/or power Doppler imaging.

- Studies may be unilateral with the use of an appropriate algorithm. However, it is required to compare the common femoral spectral waveform from the contralateral limb, in this event.
- Transverse transducer compressions (when anatomically possible and not

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contraindicated) should be performed every 2cm to ensure entire vein is assessed.

- Representative images are obtained per lab protocol.

Direct Testing: Duplex Evaluation for Venous Reflux

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

- Common femoral
- Sapheno-femoral junction (SFJ)
- Proximal femoral
- Mid femoral
- Distal femoral
- Popliteal
- Posterior tibial
- Peroneal
- Great saphenous (GSV)
- Small saphenous (SSV)
- Additional images to document areas of suspected thrombosis

The following veins are included if indicated or required by the facility specific-protocol:

- Inferior vena cava
- Common iliac
- External iliac
- Proximal deep femoral
- Gastrocnemius
- Soleal
- Anterior tibial
- Perforators

When pathology (thrombus or intraluminal echoes) is present:

- B-mode image should demonstrate the degree of compressibility
- Differentiate between partially or totally non-compressible segments
- Appearance, presence of intraluminal echoes
- Document location, extent and echogenicity of thrombus
- Differentiate between unattached proximal tips and attached thrombi.
- Note dilatation or contraction of vein to assist in describing characteristic of aging the thrombus
- Any other pathologies documented

Proper measurements usually include the following or as determined by facility protocol, and should be taken under the following conditions:

- Vein diameter measurements are acquired with the extremity(s) in a dependent position

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- Be acquired anterior wall to posterior wall, consistently, as defined by the protocol
- Assure that no external pressure is applied to the vein.
 - GSV at the SFJ
 - GSV just beyond the SFJ
 - GSV at the knee
 - SSV at the **sapheno-popliteal junction** or level of the **sapheno-popliteal junction** (40% of the time the SSV does not connect to the popliteal vein)
- Diameter measurements of all accessory saphenous veins, perforator **veins** ≥ 3.5 mm or other requirements by protocol

Spectral Doppler waveform assessment is performed in the sagittal plane. It is not required to angle correct unless measuring velocities. If angle correction is utilized, 45-60 degree angles should be maintained and aligned with the vessel wall.

Spectral Doppler waveforms for assessing venous reflux showing baseline and response to physiologic maneuvers is documented as required by the protocol and include at a minimum:

- Proximal common femoral vein, bilaterally
- Sapheno-femoral junction (SFJ)
- Mid femoral vein
- Great saphenous vein (GSV) above the knee and below the knee
- Popliteal vein
- Sapheno-popliteal junction (SPJ)
- Small saphenous vein (SSV)
- Suspected areas of venous valvular reflux, including representative spectral Doppler waveforms
- Documented reflux time measured in milliseconds
- Representative color Doppler image is documented as required by the facility protocol
- Any additional sites indicated or required by the facility-specific protocol (e.g., anterior accessory saphenous vein, posterior accessory saphenous vein, extension of the small saphenous vein, varicosities, posterior tibial, peroneal, gastrocnemius veins, etc.)

The order of vessel assessment is dependent upon patient positioning. It is important to identify the presence and define the location of perforating veins. Size and incompetence should be documented when discovered.

REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review data acquired during the lower extremity venous insufficiency evaluation 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).
- To determine any change in follow-up studies, review previous exam documentation to document any change in status; and/or 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 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.

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