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**VASCULAR TECHNOLOGY
PROFESSIONAL PERFORMANCE GUIDELINES**

Lower Extremity Venous Insufficiency Evaluation

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Sponsored and published by:
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Lower Extremity Venous Insufficiency Evaluation

PURPOSE

To evaluate the deep and superficial venous systems for evidence of valvular incompetence.

COMMON INDICATIONS

Common indications for the performance of lower extremity venous reflux evaluation include, but are not limited to:

- Preoperative evaluation for venous insufficiency
- Venous ulcers
- Pain or feelings of heaviness in the lower extremity
- Visible varicose veins
- Pain, edema, discoloration

CONTRAINDICATIONS AND LIMITATIONS

Contraindications for lower extremity venous insufficiency evaluation are unlikely; however, some limitations exist and may include the following:

- Obesity
- Open draining ulcers
- Severe edema
- Inability to stand for an extended length of time

GUIDELINE 1: PATIENT COMMUNICATION

- 1.1 Introduce yourself to the patient and explain why the evaluation 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 Lower Extremity Venous Insufficiency Evaluation.
- 1.4 Educate patients about risk factors for, and symptoms of, lower extremity venous insufficiency.
- 1.5 Refer specific diagnostic, treatment or prognostic questions to the patient's physician.

GUIDELINE 2: PATIENT ASSESSMENT AND PHYSICAL EXAMINATION

Patient assessment must be performed before the evaluation. This includes assessment of the patient's ability to tolerate the procedure and an evaluation of any contraindications or limitations that may apply to the performance of the procedure.

- 2.1 Obtain a complete, pertinent history by interview of the patient or patient's representative and review of the patient's medical record. A pertinent history includes:
 - a. Relevant risk factors for lower extremity venous insufficiency, previous deep vein and/or superficial vein thrombosis (DVT/SVT), lower extremity trauma, history of venous ulcers and/or varicosities, familial history of varicose veins.
 - b. Current medications or therapies
 - c. Results of other relevant diagnostic procedures.
- 2.2 Complete a limited or focused physical exam, which includes observation and localization of the presence of any signs or symptoms of peripheral venous disease: swelling, pain, tenderness, discoloration, varicosities, and ulceration.
- 2.3 When directed, perform adjunctive procedures: lower extremity limb diameter measurements; palpation of pedal pulses.
- 2.4 Verify that the requested procedure correlates with the patient's clinical presentation.

GUIDELINE 3: EXAMINATION GUIDELINES

3A. DIRECT TESTING: DUPLEX EVALUATION FOR VENOUS REFLUX

3B. INDIRECT TESTING: PHYSIOLOGIC EVALUATION FOR VENOUS REFLUX

3A. DIRECT TESTING: DUPLEX EVALUATION FOR VENOUS REFLUX

Throughout each exam, sonographic characteristics of normal and abnormal tissues, structures, and blood flow must be 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, with modifications made to the procedure plan according to changes in the patient's clinical status during the procedure. Also, 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.

A standard modified examination is performed to rule out the presence of a deep vein thrombosis evaluating the common femoral, proximal great saphenous (greater saphenous), femoral (superficial femoral) and popliteal veins as well as the posterior tibial, anterior tibial and peroneal veins to the level of the ankle, for normal compression and normal Doppler spectral waveform characteristics as per the SVU Professional Guideline for Lower Extremity Venous Evaluation for Deep Vein Thrombosis. Chronic deep venous obstructions, recanalization, collateralization, and incompetent perforator locations should be noted on the technologist's worksheet. If no evidence of acute DVT is noted, proceed to the protocol below to evaluate for venous insufficiency.

The position for lower extremity duplex evaluation for venous reflux is with the legs in a dependent position, either by having the patient lying supine in the reverse Trendelenberg position (feet 15-20 degrees lower than the heart) or standing. In the standing position, the patient is asked to stand facing the sonographer with the leg to be examined rotated slightly externally. The patient is asked to put most of his/her weight on the opposite leg. The patient should stand on a platform with a support bar so that they are at a height such that the sonographer can comfortably interrogate the limb from the groin to the ankle. The sonographer sits on an adjustable chair, so that they are in an ergonomically correct position for scanning. Alternately, for scanning below the knee, the patient may be seated on a high chair or exam table so that the heart is equal to or above the standing hydrostatic indifference point (HIP), the examiner is seated below with the limb to be examined resting on the examiner's knee. A combination of sitting and standing can be used dependent on the patient's physical condition.

- 3.1a Use appropriate duplex instrumentation, which includes display of both two-dimensional structure and motion in real-time, color flow imaging capabilities, and Doppler ultrasonic signal documentation with:
 - a. Doppler spectral analysis
 - b. Imaging carrier frequency of at least 5.0 MHz
 - c. Doppler carrier frequency of at least 3.0 MHz
 - d. Videotape, film or digital storage of static images and/or cineloop
 - e. An automatic cuff inflation system or manual "quick release" valve and a wide boor, 17cm wide cuff greatly simplifies the exam and standardizes the results.
- 3.2a Follow a standard exam protocol. Studies may be unilateral or bilateral. A complete venous duplex reflux evaluation incorporates both B-mode imaging and Doppler spectral analysis (maintaining a 60 degree angle or less), complemented with color flow imaging as indicated. It may be necessary to have an assistant apply manual compression to the extremity distally if automatic cuff inflation devices are not employed. Use of a blood pressure cuff and a manual cuff inflator may be useful, especially on larger extremities. The common femoral vein, proximal to the sapheno-femoral junction, the sapheno-femoral junction, the great (greater) saphenous vein, the femoral vein (superficial femoral), the popliteal vein (above and below the popliteal junction when identified) and the small (lesser) saphenous vein as well as perforating veins are interrogated with duplex imaging. The order of vessel assessment is dependent on patient positioning. It is important to rule out chronic deep venous obstruction of the calf veins and to identify the presence and define the location of incompetent perforators. Evaluation of the sapheno-femoral junction can be performed in either the supine or standing position and is dependent on the patient's physical condition.
 - a. The vein is first identified in the transverse plane.
 - b. The transducer is turned sagittally to evaluate for venous reflux, utilizing both spectral and color Doppler, assuring that the Doppler cursor is appropriately aligned with the vessel wall. Manual augmentation (or the use of a blood pressure cuff and compression device) is applied distal to the vessel interrogated for venous reflux.
 - c. A representative Doppler spectral waveform is obtained and recorded.
 - d. The examination continues to the next vein segment as listed above. Each vein is tested for reflux in the proximal, mid and distal vein segment, as well as, at the junction of large branches or perforator veins.
- 3.3a Evaluation for Perforator Incompetence Identification of Perforators followed by evaluation for reflux is performed with the patient standing or sitting on the side of the exam table with the legs dependent for examination of the below the knee veins. Proximal or distal augmentation is performed with color and/or spectral Doppler to evaluate for venous valvular reflux. Perforators should be identified in all three chambers of the calf (anterior, posterior and lateral). Hard copy documentation of the presence or absence of reflux should be obtained.

3B. INDIRECT TESTING: PHYSIOLOGIC EVALUATION FOR VENOUS REFLUX

Throughout each exam, characteristics of normal and abnormal blood flow must be evaluated so that techniques may be adjusted as necessary to optimize the quality of the examination. The patient's physical and mental status is assessed and monitored during the examination, with modifications made to the procedure plan according to changes in the patient's clinical status during the procedure. Additionally, data is analyzed throughout the examination to ensure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.

Venous valvular incompetence may be assessed indirectly by documentation of venous refilling time (VRT) in the tissues of the lower extremity. Most often, photoplethysmography is employed to determine venous refill time in the microcirculation of the lower calf. Venous emptying is accomplished by intermittent manual or cuff compression of the limb or by having the patient perform plantar and dorsiflexion maneuvers.

For physiologic evaluation of venous refill time, the patient is seated on a high chair or examination table with the legs dependent.

3.1b Instrumentation includes:

- a. photoplethysmographic sensors
- b. strip chart recorder
- c. blood pressure cuffs appropriately sized according to the patient's limb diameter
- d. sphygmomanometer

3.2b Follow a standard examination protocol. Studies may be bilateral or unilateral. A photoplethysmographic sensor is applied with double-stick tape to the medial aspect of the lower calf. A baseline tracing is obtained on the strip chart recorder. While continuing the recording, the calf veins are emptied using flexion maneuvers, manual or cuff compression. Immediately following the emptying maneuver, the limb is allowed to hang dependently without support and the venous refilling time is recorded on the strip chart.

If an abnormal venous refill time is documented, it is important to determine if the valvular incompetence is related to the superficial or deep venous system. This can be accomplished with application of above knee and / or below knee tourniquets. An above knee cuff may be inflated to a pressure adequate to compress the great (greater) saphenous vein. The photoplethysmographic examination is repeated as above. If an abnormal VRT without tourniquets normalizes with application of the above knee tourniquet, valvular incompetency in the great (greater) saphenous system is suggested. If the study remains abnormal, the tourniquet cuff may be placed around the proximal calf to eliminate both the great (greater) and small (lesser) saphenous veins.

If an abnormal VRT without tourniquets normalizes with application of the above knee tourniquet, valvular incompetency in the great (greater) saphenous system is suggested. If the study remains abnormal, the tourniquet cuff may be placed around the proximal calf to eliminate both the great (greater) and small (lesser) saphenous veins.

If the abnormal VRT then becomes normal, small (lesser) saphenous venous incompetence is suggested. If the study remains abnormal with elimination of both the great (greater) and small (lesser) saphenous veins, deep venous incompetence is suggested.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

- 4.1 Review data acquired during the Lower Extremity Venous Reflux Evaluation to ensure that a complete and comprehensive evaluation has been performed and documented.
- 4.2 Explain and document any exceptions to the routine Lower Extremity Venous Reflux Evaluation protocol (i.e., study omissions or revisions).
- 4.3 To determine any change in follow-up studies, review previous exam documentation so that the current evaluation can document any change in status. The examination protocol may need to be modified to address current physical needs.

- 4.4 Record all technical findings required to complete the final diagnosis on a worksheet by using other appropriate methods i.e., computer software, so that the findings can be classified according to the laboratory diagnostic criteria [these criteria must be based on published or internally validated data (see appendix)]
- 4.5 Document exam date, clinical indication(s), technologist performing the evaluation and exam summary in a laboratory logbook or by other appropriate method, i.e. computer software.

GUIDELINE 5: PRESENTATION OF EXAM FINDINGS

- 5.1 Provide preliminary results when necessary as provided for by internal guidelines based on the Lower Extremity Venous Reflux Evaluation findings.
- 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 Lower Extremity Venous Reflux Evaluation findings.

GUIDELINE 6: EXAM TIME RECOMMENDATIONS

High quality, accurate results are fundamental elements of the lower extremity venous reflux evaluation. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy. Total recommended time allotment (Indirect ND Direct Components) is 75 minutes (for bilateral examination).

- 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 35-45 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), the individual must keep current with:

- Advances in diagnosis and treatment of venous disease
- Changes in Lower Extremity Venous Reflux Evaluation protocols or published laboratory diagnostic criteria.
- Advances in ultrasound technology used for the Lower Extremity Venous Reflux Evaluation.
- Advances in other technology used for the Lower Extremity Venous Reflux Evaluation.

APPENDIX

It is recommended that published or internally generated diagnostic criteria should be validated for each ultrasound system used. When validating diagnostic criteria for sonographic examinations, it is important to realize that equipment, operator and interpretation variability are inherent to this process.

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