VASCULAR TECHNOLOGY
PROFESSIONAL PERFORMANCE GUIDELINES

Upper Extremity Venous Duplex Evaluation R/O Deep/Superficial Vein Thrombosis

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Upper Extremity Venous Duplex Evaluation
R/O Deep / Superficial Vein Thrombosis

PURPOSE

Duplex imaging of the upper extremity veins is performed to assess the deep and superficial venous system of the upper extremity to determine the presence or absence of pathology and to facilitate clinical management decisions.

COMMON INDICATIONS

Some of the common indications for performance of upper extremity venous duplex imaging include, but are not limited to:

- Swelling
- Pain
- Tenderness
- Palpable (arm) cord
- Prior to central line placement

CONTRAINDICATIONS AND LIMITATIONS

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

- Patients who are very obese patients have very deep vessels.
- People who are very thin have very superficial vessels
- Patients in a cast will limit the areas accessible to be scanned
- Patients with trauma or open wounds will limit the scan area
- Patients with severe edema
- Patients with a central venous line or dialysis access may have limited visibility of the subclavian vein
- Visualization of the entire length of the subclavian vein is hampered by the clavicle

GUIDELINE 1: PATIENT COMMUNICATION AND POSITIONING

The technologist/sonographer/examiner should:

1.1. Introduce self and explain why the Upper Extremity Venous 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 Upper Extremity Venous Evaluation.

1.4 Refer specific diagnostic, treatment or prognosis questions to the patient's physician.

1.5 The patient is positioned in the supine position with the arm relaxed and extended out to the side.

1.6 The patient may be examined in the sitting position if the venous structures are small and very superficial. This facilitates dilatation of the veins.

GUIDELINE 2: PATIENT ASSESSMENT

Patient assessment must be performed before Upper Extremity Venous Duplex Evaluation. This includes assessment of the patient's ability to tolerate the procedure and an evaluation of any contra-indications to the procedure.

The technologist/sonographer/examiner should:

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. Current medical status, especially symptoms related to upper extremity venous thrombosis.
   b. Previous surgeries or invasive procedures involving the affected arm or neck.
   c. Presence of any risk factors: previous upper extremity vein thrombosis or trauma, recent or past surgery on the affected extremity (recent or prior dialysis access graft surgery, dialysis catheter, central venous line or chemotherapy access port insertions, and history of cancer).
   d. Current medications or therapies
   e. Results of other relevant diagnostic procedures.

2.2 Complete a limited or focused physical exam, which includes observation and localization of pain and swelling.

2.3 Verify that the requested procedure correlates with the patient's clinical presentation.

GUIDELINE 3: EXAMINATION GUIDELINES

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.

3.1 Use appropriate duplex instrumentation, which includes display of both two-dimensional structure and motion in real-time and Doppler ultrasonic signal documentation with:
   a. Spectral analysis with or without color Doppler imaging
   b. Imaging carrier frequency of at least 5.0 MHz
   c. Doppler carrier frequency of at least 3.0 MHz
   d. Video tape, film or digital storage of static images and/or cineloop

3.2 Follow a standard exam protocol for each segments evaluated. Studies may be unilateral with the use of an appropriate algorithm. A complete venous duplex evaluation incorporates both B-mode image and Doppler spectrum with color flow if available. This will require multiple acoustic windows and patient positioning techniques.

The internal jugular (IJV), subclavian (SubV), upper extremity deep (axillary, brachial, radial and ulnar) and superficial (basilic, cephalic and median cubital) veins should be interrogated in their entirety.

The standard exam includes B-mode images, utilizing the transverse imaging plane, noting that parts of the subclavian vein (SubV) are not visible due to the clavicle. The infraclavicular and thoracic outlet segments of the SubV can usually be evaluated through the anterior chest wall. The IJV and SubV are typically assessed by both Doppler spectral and color-flow analysis. The innominate vein should be evaluated when appropriate.

a. Representative gray scale imaging documentation, with and without transverse transducer compressions (when anatomically possible or not contraindicated) must be performed every 2 cm's.
b. If pathology is present, whenever possible: compressibility, appearance, location, extent, severity should be documented. B-Mode data interpretation should attempt to classify compressibility, intraluminal echoes, and dilation. The technologist should differentiate between brightly echogenic or lightly echogenic thrombi, partially or totally non-compressible segments, and between free-floating/unattached proximal tips and attached thrombi. Thrombus should be aged whenever possible. Acute thrombus refers to thrombus that is usually days to 1 or 2 weeks old.
c. Spectral and color Doppler are used to further support the diagnosis and to document information about flow patterns such as spontaneity, phasicity, abnormal venous flow, and for the documentation of reflux. A representative Doppler spectral waveform must be obtained from each of the specified vessels demonstrating the presence or absence of spontaneous blood flow and cardio-respiratory variation. Doppler spectral analysis is performed in the sagittal plane, with an angle of 60 degrees or less with respect to the direction of blood flow, and Doppler cursor alignment is recommended parallel to the vessel walls. To ensure complete interrogation, spectral waveforms are routinely performed while utilizing proximal (or Valsalva technique) and distal compression of the limb demonstrating augmentation. When appropriate indications, this response to blood flow augmentation maneuvers must be documented.
d. With unilateral evaluations, a contralateral Doppler spectral waveform from the IJV and/or SubV must be documented.

3.3 To determine any change in follow-up studies, review previous exam documentation so that the current evaluation can document any change in status; and, to duplicates prior imaging and Doppler parameters. The examination protocol may need to be modified to address current physical needs.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The technologist/sonographer/examiner should:

4.1 Review data acquired during the Upper Extremity Venous Duplex Evaluation to ensure that a complete and comprehensive evaluation has been performed and documented.

4.2 Explain and document any exceptions to the routine Upper Extremity Venous Duplex Evaluation protocol (i.e., study omissions or revisions).

4.3 Document exam date, clinical indication(s), technologist performing the evaluation and exam summary in a laboratory logbook or other appropriate method, i.e. computer software.

4.4 Document study results in a laboratory logbook, where performance of the exam, interpretation of exam results, and final diagnosis are recorded.

4.5 Alert vascular laboratory Medical Director or appropriate health care provider when immediate medical attention is indicated based on the Upper Extremity Venous Duplex Evaluation findings.

GUIDELINE 5: PRESENTATION OF EXAM FINDINGS

The technologist/sonographer/examiner should:

5.1 Provide preliminary results when necessary as provided for by internal guidelines based on the Upper Extremity Venous Duplex 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.

GUIDELINE 6: EXAM TIME RECOMMENDATIONS

High quality, accurate results are fundamental elements of the upper extremity venous evaluation. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy. Total recommended time allotment 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 & 2); 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 measures an individual's competence to perform vascular technology at the entry level. After achieving certification, all Registered Vascular Technologists must keep current with:

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

APPENDIX

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

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