



**VASCULAR TECHNOLOGY
PROFESSIONAL PERFORMANCE GUIDELINES**

Upper Extremity Mapping for Creation of Dialysis Access or Bypass Graft

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VASCULAR PROFESSIONAL PERFORMANCE GUIDELINE

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PURPOSE

Duplex imaging of the upper extremity, prior to the creation of dialysis access or bypass graft, is performed to assess the superficial venous system, specifically to determine diameter, length, and suitability of the superficial veins. Additionally, the central venous system and upper extremity arterial system are evaluated for patency prior to the creation of dialysis access.

APPROPRIATE INDICATIONS

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

Venous Mapping

- history of thrombus in the veins
- swelling of the extremity
- veins appear small or are not visible on clinical exam
- previous failed hemodialysis access

Arterial Mapping

- history of Raynaud's disease
- history of claudication
- signs and symptoms of ischemia
- known stenosis or arterial calcification
- history of aneurysm

CONTRAINDICATIONS AND LIMITATIONS

Contraindications and limitations may include the following:

- Obesity
- Recent surgery in the region of exam, the presence of intravenous lines, casts, surgical staples/dressings, open wounds, hematoma
- Patients with severe edema/swelling
- Previous vein harvesting or stripping
- Involuntary movement or inability to remain still during examination
- Studies done at the bedside may be limited due to patient access and room dimensions.

PATIENT COMMUNICATION

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

- Introduce themselves, 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 the patient about risk factors for and symptoms of deep/superficial vein thrombosis.
- Refer specific diagnostic, treatment, or prognosis questions to the patient's physician

PATIENT ASSESSMENT

A patient assessment should be completed before the duplex evaluation. This includes an assessment of the patient's ability to tolerate the procedure and an evaluation of any contraindications. The sonographer or examiner should obtain a complete, pertinent history by interview of the patient or the patient's representative, and review the patient's medical record, if available. A pertinent history includes:

- Determining and documenting the non-dominant upper extremity
- Proposed surgery for the patient
- Previous deep or superficial venous thrombosis
- Upper extremity trauma
- Previous vein harvesting or stripping
- IV drug use
- Current medications and/or therapies (including central venous or subclavian catheters)
- Results of other relevant diagnostic procedures
- Verify that the requested procedure correlates with the patient's clinical presentation

Complete a limited or focused physical exam, to include but not limited to, observation and localization of any signs or symptoms of peripheral venous or arterial disease:

- Swelling
- Palpable cord
- Palpate radial, ulnar, and brachial pulses
- Bilateral brachial blood pressure
- Modified Allen's test
- Discoloration (including hands and digits)
- Ulceration

PATIENT POSITIONING

- Positioning is supine, in sitting position or reverse Trendelenburg to promote vein dilatation, with the arm relaxed and extended out to the side. For patient comfort, it is helpful to support the arm on a bedside table/pillow.
- The room should be warm and limbs covered until ready to be imaged to reduce vasoconstriction.

INSTRUMENTATION

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

- Typically, a linear 5-18 MHz transducer
 - Superficial structures may require higher frequency
 - Deeper structures or edematous tissue may require a lower frequency transducer
 - Subclavian imaging may require a lower frequency, 2-5 MHz curved linear or phased array transducers for larger patients

- Display of two-dimensional structure and motion in real-time
 - Grayscale imaging
 - Spectral analysis with color and/or power Doppler imaging
- Digital storage of images

EXAM PROTOCOL

Sonographers 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 upper extremity vessels.

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
- Accurately annotate grayscale imaging, color Doppler and spectral analysis
- Duplex examinations are bilateral unless otherwise

indicated:

- Representative images are obtained per lab protocol.
- If veins of the non-dominant arm are determined to be inadequate in size for use as a conduit, or if abnormalities are identified, the dominant arm is then assessed following the same scanning procedure.
- Observe for any indication of proximal or central vein obstruction, such as large collateral veins of the neck, chest, or upper arm.
- Observe continuity of the cephalic and basilic veins into the confluence of the deep venous system. Document the presence of any large branches or anomalies in the upper extremity veins.
- If dilatation of the veins is limited, a tourniquet may be placed high on the upper arm. Warm compresses may also be used to maximize vein dilation and are more comfortable for the patient.
- Vein diameters of the brachial, cephalic, and basilic veins are measured in the transverse plane
- The depth of the vein from the skin line is also a useful measurement.
- The median cubital vein should be identified, when possible, noting the area of the proximal and distal antecubital space.
- If duplicated systems are identified and the vessel diameters are

- adequate, record measurements.
- If requested, map the course of the vein(s) using an indelible marker.

Transverse grayscale images with and without transducer compressions include evaluation of the superficial vein to be used for conduit, and a deep venous evaluation, these include the:

- Internal jugular vein
- Subclavian vein
- Axillary vein
- Brachial vein
- Basilic vein (deep venous confluence to proximal forearm)
- Cephalic vein (deep venous confluence to wrist)
- Medial cubital vein (antecubital vein)

Diameter measurements are indicated by the planned procedure type, but typically include transverse, anterior wall to posterior wall, measurements of the:

- Basilic vein (deep venous confluence to proximal forearm)
- Cephalic vein (deep venous confluence to wrist)
- Medial cubital vein (antecubital vein)

Spectral and/or color Doppler images include the following:

- Internal jugular vein
- Subclavian vein
- Axillary vein
- Brachial vein
- Basilic vein
- Cephalic vein
- The following are included if indicated or required by the facility specific-protocol:
 - Jugular-subclavian junction, innominate (brachiocephalic), radial or ulnar veins

Additional arterial images are included for pre-hemodialysis access mappings, per lab protocol:

- Diameter measurements and spectral Doppler waveforms
 - Brachial artery
 - Radial artery (proximal and distal)
 - Ulnar artery

REVIEW OF THE DIAGNOSTIC EXAM FINDINGS

The sonographer or examiner should:

- Review data acquired during the upper extremity vein mapping exam to ensure that a complete and comprehensive evaluation has been performed and documented

- Explain and document any exceptions 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 upper extremity mapping findings.
- Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician for use in interpretation.
- The sonographer's and 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 healthcare 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 upper extremity vein mapping 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, and 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).

- G0365 105 minutes

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