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**VASCULAR TECHNOLOGY  
PROFESSIONAL PERFORMANCE GUIDELINES**

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# Upper Extremity Vein Mapping for Placement of a Dialysis Access

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# Upper Extremity Vein Mapping for Placement of a Dialysis Access

## PURPOSE

Vein mapping of the upper extremity is performed to determine diameter, length and suitability of the superficial veins of the upper extremity for placement of dialysis access.

## COMMON INDICATIONS

- To assess the availability of vessels prior to creation of a permanent dialysis access in patients with chronic renal failure (CRF).
- For patients who have not yet started hemodialysis with the thought of advanced fistula maturity when the dialysis treatment is necessary.
- Patients who have had multiple procedures may also need an exam to evaluate the possible availability of any remaining sites in an extremity for permanent access.

## CONTRAINDICATIONS AND LIMITATIONS

- IV lines and bandages may limit access to the superficial veins.
- History of ischemia, claudication, rest pain, digital ulcerations, trauma, or abnormal wrist/brachial index. These symptoms may prevent access in the extremity due to probable post operative steal and an increase in digital ischemia.
- Patient positioning may prevent accurate measurement of the superficial veins (if the arm is elevated higher than the heart).
- Open wounds may limit access to areas of the circulation and must also be protected from contamination

## **GUIDELINE 1: PATIENT COMMUNICATIONS AND POSITIONING**

### **The technologist/sonographer/examiner should:**

- 1.1 Introduce yourself and explain why the vein mapping of the upper extremity is being performed and indicate how long it will take.
- 1.2 Explain the procedure to the patient, taking care to ensure that the patient understands the necessity for each aspect of the evaluation.
- 1.3 Respond to questions and concerns about any aspect of the vein mapping of the upper extremity.
- 1.4 Refers specific diagnostic, treatment or prognosis questions to the patient's physician.
- 1.5 The patient can be supine or in a sitting position, however, the sitting position with the arms dependent does promote dilatation of the forearm and upper arm veins. If in the sitting position the arms could be resting on a pillow for patient comfort and to facilitate easy access for scanning.
- 1.6 The room should be comfortably warm in order to enhance venous dilatation.

## **GUIDELINE 2: PATIENT ASSESSMENT**

Patient assessment must be performed before the Vein Mapping of the Upper Extremity is performed. 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 their representative and/or review of the patient's medical record. A pertinent history includes:
  - a. Current medical status
  - b. Previous surgeries or invasive procedures involving the affected arm or neck
  - c. Current medications or therapies
  - d. Presence of any risk factors, recent or past surgery on the intended extremity or chest area including:
    - Insertion of a dialysis access graft
    - Recent or prior insertion of a dialysis catheter, central venous line or insertion of a chemotherapy access port
    - Pacemaker
    - Defibrillator
- 2.2 Complete a limited or focused physical exam of the extremity.

### GUIDELINE 3: EXAMINATION GUIDELINES

Throughout each exam, sonographic characteristics of normal and abnormal tissues, structures, and blood flow must be observed so that the 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, and modifications are made to the procedure plan according to changes in the patient's clinical condition during the procedure. 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.

#### **INSTRUMENTATION:**

- 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 and Doppler carrier frequency of at least 3.0 MHz to 10 MHz, as the vessels are relatively superficial and this may provide better identification of intraluminal echoes if present.
  - c. Hardcopy paper, film or digital storage capabilities
- 3.2 Follow a standard exam protocol for upper extremity vein mapping for dialysis access graft. Studies are usually unilateral, studying the *non-dominant arm* whenever possible. The exam *may* proceed to the *dominant arm* if the non-dominant arm has *inadequate* caliber veins for use as a conduit.
- 3.3 The **ARTERIAL** evaluation of the upper extremity is very important in the pre-operative assessment for placement of dialysis access. Please refer to “*Upper Extremity Arterial Physiologic Evaluation*” and “*Radial Artery Assessment for Coronary Artery Bypass*” in the **SVU Guidelines**.
- 3.4 B-mode gray scale imaging is used to assess the arm veins and in accordance with “Fistula First” a primary fistula would be a physician’s first choice for access for the patient if no previous access has been placed. To begin this exam:
  - a. Evaluate the cephalic, basilic and median cubital veins starting distally (wrist) and progressing proximally to the level of the shoulder and axilla. Patency of the more proximal deep veins should be confirmed including the brachial, axillary and subclavian.
  - b. B-Mode data interpretation includes determination that vein walls are compressible and free of thrombus. A noncompressible or partially compressible vein indicates the presence of an occluding or partially occluding thrombus within the lumen of the vein, making this portion of the vein unacceptable as a conduit.
  - c. Compressibility is the primary screening tool utilized in this exam, making sure to compress every 2 cm.
  - d. The diameter of the brachial, cephalic and basilic veins is measured in transverse view.
    - A tourniquet can be useful for maximum dilatation of the veins.
    - Place the tourniquet just distal to the antecubital fossa for the evaluation of the forearm veins.
    - Place the tourniquet on the proximal upper arm for evaluation of the veins above the antecubital fossa
  - e. The vessels are measured along their entire length, every 1-2 cm, paying particular attention to the area just proximal to, in the area of, the antecubital space, and distal to the antecubital space. Identification of the median cubital vein is made whenever possible.
  - f. Any abnormalities including vein thrombosis in the deep or superficial systems, calcification, and wall thickening are identified and documented.

- 3.5 Spectral Doppler and/or Color:
  - a. Doppler spectral analysis is performed in the sagittal plane. All Doppler samples must be performed at 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.
  - b. Color Doppler may be used to verify patency of these veins.
  - c. To ensure complete interrogation of the venous system, spectral waveforms are performed while utilizing proximal and/or distal compression of the limb to demonstrate augmentation
  - d. Record a representative waveform of the venous system demonstrating the compression maneuver.
  - e. Doppler signals of the venous system are evaluated for spontaneity, phasicity, and augmentation
- 3.6 If none of the veins in the non-dominant arm are of adequate size to be used as a conduit, or if any abnormalities are identified, attention is turned to the dominant arm. The same scanning procedure is followed.

#### **GUIDELINE 4: REVIEW OF THE DIAGNOSTIC ULTRASOUND EXAM FINDINGS**

- 4.1 Review data acquired during the Upper Extremity Vein Mapping for Dialysis Access Examination 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 Vein Mapping for Dialysis Access Examination protocol (i.e., study limitations, omissions or revisions).
- 4.3 Record all technical findings required to complete the final interpretation on a worksheet, logbook or other form so that the findings can be classified according to the laboratory's diagnostic criteria based on published or internally validated data.
- 4.4 Document the exam date, clinical indication(s), technologist performing the exam, and the exam summary in a vascular laboratory logbook, or other appropriate method, i.e., computer software, etc.
- 4.5 Alert the health care provider when immediate medical attention is indicated based on the Upper Extremity Vein Mapping for Dialysis Access Examination findings.

#### **GUIDELINE 5: PRESENTATION OF EXAM FINDINGS**

- 5.1 Provide preliminary results when necessary as provided for by internal guidelines.
- 5.2 Present record of data, explanations, and technical worksheet to the interpreting physician for use in rendering a diagnosis and for archival purposes.
- 5.3 Presents 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 and accurate results are fundamental elements of the vein mapping of the upper extremity examination. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy.

- 6.1 Indirect exam components include pre-exam procedures: obtaining previous exam data; completing pre exam paperwork; exam room and equipment preparatory activities; patient assessment and positioning (Guideline 1 & 2); and, post-exam procedures: cleanup; compiling, processing, reviewing exam data for preliminary and/or formal interpretation (Guidelines 3 and 4); patient communication (Guideline 2); exam charge and billing activities. Recommended time allotment is 25 minutes.

- 6.2 Direct exam components include equipment optimization, patient positioning throughout the exam and the actual hands-on, examination process (Guideline 3). Recommended time allotment is 35-45 minutes for a unilateral exam, longer if bilateral.

## **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), an individual must keep current with:

- 7.1 Advances in diagnosis and treatment of venous disease
- 7.2 Changes in vein mapping protocols or published laboratory diagnostic criteria involving dialysis access
- 7.3 Advances in ultrasound technology used for the vein mapping 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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