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## Peripheral Venous Ultrasound Protocol

**Reviewed by:** Mark Yuhasz, MD**Last Review Date:** January 2015**Contact:** (866) 761-4200, Option 1**Indications:**

The indications for peripheral venous ultrasound examinations include, but are not limited to:

1. Evaluation of possible venous thromboembolic disease or venous obstruction in symptomatic or high-risk asymptomatic individuals.
2. Assessment of venous insufficiency, reflux, and varicosities.
3. Assessment of dialysis access.
4. Venous mapping prior to surgical procedures.
5. Evaluation of veins prior to venous access.
6. Follow-up for patients with known venous thrombosis near the anticipated end of anticoagulation to determine if residual venous thrombosis is present.

**Required Images**

The requesting health care provider should be encouraged to provide the pretest probability of acute deep venous thrombosis and/or the results of D-dimer assay if known.

Note: The words proximal and distal refer to the relative distance from the attached end of the limb per Gray's Anatomy. For example, the proximal femoral vein is closer to the hip and the distal femoral vein is closer to the knee. The longitudinal or long axis is parallel to or along the length of the vein. Transverse or short axis is perpendicular to the long axis of the vein.

Venous Thromboembolic Disease: Lower Extremity

**A. Technique**

- Compression ultrasound: The fullest visualized extent of the common femoral, femoral (formerly known as the superficial femoral) and popliteal veins must be imaged using optimal grayscale compression technique. The popliteal vein is examined distally to the

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tibioperoneal trunk. The proximal deep femoral and proximal great saphenous veins should also be examined. Venous compression is applied in the transverse plane with adequate pressure on the skin to completely obliterate the normal vein lumen.

- Focal symptoms will generally require evaluation of those areas.
- At a minimum (even if the examination is otherwise unilateral), right and left common femoral or right and left external iliac venous spectral Doppler waveforms should be recorded to evaluate for asymmetry or loss of respiratory phasicity. A popliteal venous spectral Doppler waveform of the symptomatic leg should also be obtained. All spectral Doppler should be obtained from the long axis.
- Color or spectral Doppler evaluation can be used to support the presence or absence of an abnormality.

## B. Recording

- For normal examinations, at a minimum:

Grayscale images should be recorded without and with compression at each of the following levels:

- a. Common femoral vein
- b. Junction of the common femoral vein with the great saphenous vein
- c. Proximal deep femoral vein
- d. Proximal femoral vein
- e. Distal femoral vein
- f. Popliteal vein

Spectral Doppler waveforms from the long axis should be recorded at each of the following levels:

- a. Right common femoral or external iliac vein.
  - b. Left common femoral or external iliac vein.
  - c. Popliteal vein on symptomatic side, or on both sides if there are bilateral symptoms.
- Abnormal findings generally require additional images to document the complete extent of the abnormalities.
    - a. Symptomatic areas such as the calf generally require additional evaluation and additional images if the cause of the symptoms is not readily elucidated by the

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standard examination.

- b. The extent and location of sites where the veins fail to compress completely should be clearly recorded and generally require additional images. Long axis views without compression may be helpful to characterize the abnormal vein.
- The patient presentation, clinical indication, or clinical management pathways may require protocol adjustments such as more detailed evaluation of the superficial venous system, evaluation of the deep calf veins, or a bilateral study.
  - Other vascular and nonvascular abnormalities, if found, should be recorded, but may require additional imaging for diagnosis or further characterization. Anatomical variations such as duplications should be noted.

## Venous Insufficiency

- Technique
  - a. When evaluating for venous insufficiency, the location and duration of reversed blood flow should be determined during the performance of accepted maneuvers.
  - b. Duplex interrogation should be performed at as many levels as necessary to ensure a complete examination based on the clinical indications. Generally veins in the superficial and deep system should be evaluated.
  - c. Augmentation with squeezing of the calf musculature should generally be used. Valsalva may be used at the groin.
  - d. The patient should be positioned in the erect position for the detection or exclusion of reflux. The reverse Trendelenburg position can be used if erect scanning is not possible. The examined leg should be in a non-weight-bearing position. The patient should not be studied for reflux in the supine position.
  - e. All spectral Doppler should be obtained from the long axis.
- Recording
  - a. Recordings should document the extent and location of reflux. Varicosities and abnormal perforating veins should generally also be documented.
  - b. Recording the size of dilated vessels may be helpful for clinical management.
  - c. Anatomical variations such as hypoplastic or aplastic segments, significant accessory veins, or duplications should be noted.

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- a) The patient presentation, clinical indication, or clinical management pathways may require protocol adjustments such as more detailed evaluation of the deep venous system or a bilateral study.
- b) Other vascular and nonvascular abnormalities, if found, should be recorded, but may require additional imaging for diagnosis or further characterization.

## Venous Thromboembolic Disease: Upper Extremity

- **Technique**

Upper extremity duplex evaluation consists of grayscale and Doppler assessment of all the accessible portions of the subclavian, innominate, internal jugular, and axillary veins, as well as compression grayscale ultrasound of the brachial, basilic, and cephalic veins in the upper arm to the elbow. All accessible veins should be scanned using optimal grayscale and Doppler techniques as well as appropriate positioning. Venous compression is applied to accessible veins in the transverse plane with adequate pressure on the skin to completely obliterate the normal vein lumen.

Symptomatic areas, such as the forearm, may require additional evaluation, if the cause of the symptoms is not already elucidated by the standard examination.

- **Recording**

For each normal examinations, at a minimum:

Grayscale images should be recorded without and with compression at each of the following levels:

- a. Internal jugular vein.
- b. Peripheral subclavian vein.
- c. Axillary vein.
- d. Brachial vein in the arm.
- e. Cephalic vein in the arm.
- f. Basilic vein in the arm.
- g. Focal symptomatic areas, if present.

Color images are recorded at each of the following levels using appropriate color technique to demonstrate filling of the normal venous lumen:

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- a. Internal jugular vein
  - b. Subclavian vein
  - c. Axillary vein
  - d. If seen, the innominate vein should be recorded with color Doppler
- At a minimum (even if the examination is otherwise unilateral), the right and left subclavian venous spectral Doppler waveforms should be recorded to evaluate for asymmetry or loss of cardiovascular pulsatility and respiratory phasicity. All spectral Doppler should be obtained from the long axis.
    - a. Right subclavian vein.
    - b. Left subclavian vein (from same location in the vein and in same patient position as the right one).
  - Abnormal examinations generally require additional images. The extent and location of sites where the veins fail to compress or fill with color completely should be clearly recorded and generally require additional images. Long axis views without compression may be helpful to characterize the abnormal vein.
  - The patient presentation, clinical indication, or clinical management pathways may require protocol adjustments such as imaging the forearm veins or performing a bilateral study.
  - Other vascular and nonvascular abnormalities, if found, should be recorded, but may require additional imaging for diagnosis or further characterization.

## Vein Mapping

Mapping of superficial leg or arm veins is performed to determine the patency, size, condition (such as calcification or thickening), and the course of superficial veins to be used for vein grafts. The location of the vein may be marked on the skin overlying the veins. Tourniquets or other methods to accentuate the veins may be used based on the clinical indication (for instance, mapping prior to hemodialysis grafts or fistulas).