

Venous Thrombosis Ultrasound Protocol

Reviewed by: Spencer Lake, MD
Last Review Date: November 2020

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. Follow-up for patients with known venous thrombosis near the anticipated end of anticoagulation to determine if residual venous thrombosis is present.
3. Evaluation of veins prior to venous access.

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 Thrombosis Evaluation: 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. Compressions should be performed in real time every 1-2 cm along the entirety of the vessels, with note made of any section greater than 2 cm where compression is technically limited or could not be directly visualized; only the images described below need to be recorded, however. The popliteal vein should be examined as well as the tibioperoneal trunk, with evaluation of the proximal calf veins as described below. The proximal deep femoral and great saphenous veins should also be examined, including at the saphenofemoral junction and bifurcation of the common femoral vein. Venous compression is applied in the transverse plane with adequate pressure on the skin to completely obliterate the normal vein lumen.

- Focal symptoms will also require targeted evaluation of those areas.
- At a minimum (even if the examination is otherwise unilateral), right and left common femoral veins should always be evaluated as detailed below to evaluated for asymmetry or loss of respiratory phasicity.
- Color or spectral Doppler evaluation can be used to support the presence or absence of an abnormality. All spectral Doppler should be obtained from the long axis.
- See below for required images.

B. Recording

- For normal examinations, at a minimum:

Dual side-by-side grayscale images should be recorded without and with compression at each of the following levels, in addition to sagittal image with color:

- 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 (can be shown on same image as proximal deep femoral vein or separately)
- e. Mid femoral vein
- f. Distal femoral vein
- g. Popliteal vein
- h. Peroneal vein
- i. Posterior tibial vein

If compression is difficult to demonstrate clearly on still images, consider either placing arrow or calipers at the site of the compressed vessel or recording a cine demonstrating the compression.

Spectral Doppler waveforms from the long axis should be recorded at each of the following levels to document spontaneous flow and respiratory phasicity. Augmentation is not currently required per Intersocietal Accreditation Commission:

- a. Ipsilateral common femoral vein
- b. Contralateral common femoral vein
- c. Saphenofemoral junction
- d. Femoral vein (mid)
- e. Popliteal vein

Ensure that the scale is not set too high, which can make the waveforms appear flat with continuous flow (an abnormal finding raising concern for more central obstruction). The waveform should fill approximately 75% of the box.

- Calf veins

Symptomatic areas such as the calf generally require additional targeted evaluation and additional images if the cause of the symptoms is not readily elucidated by the standard examination. If the patient has focal symptoms at the calf, attempt should be made to document patency of the gastrocnemius veins in addition to the peroneal and posterior tibial veins.

- Abnormal findings generally require additional images to document the complete extent of the abnormalities.
 - a. The extent and location of sites where the veins fail to compress completely should be clearly recorded and generally require additional images. If thrombus is suspected, it should be shown in gray-scale with compression, in longitudinal plane showing echogenicity and extent of thrombus, in longitudinal color flow to demonstrate complete vs. partial occlusion, and with spectral Doppler above, in, and below the thrombus. If thrombus extends centrally into the pelvis beyond where it can be visualized, evaluation of the IVC should be performed.
 - b. If continuous flow with flat waveform is noted on the symptomatic side, evaluation is indicated more centrally as far as can be visualized in the pelvis (external and common iliac veins) as well as of the IVC. Can consult with radiologist to see if indicated if waveform is not clear.
 - c. If superficial vein thrombus is identified, please document the extent in the same manner as described above.
- 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. If questions, please consult with radiologist.
- 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 Thromboembolic Disease: Upper Extremity

- Technique

Upper extremity duplex evaluation consists of grayscale and Doppler assessment of all the accessible portions of the internal jugular, subclavian, axillary, and brachial veins, as well as compression grayscale ultrasound of the 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 examination, at a minimum:

Dual side-by-side grayscale images should be recorded without and with compression at each of the following levels. In the arms, vein compression should be performed in real time by the sonographer every 1-2 cm along the entirety of the vessels to the level of the antecubital fossa, with the recording of the images described below.

- a. Internal jugular vein.
- b. Peripheral subclavian vein if possible.
- c. Axillary vein.
- d. Brachial veins – proximal, mid, & distal.
- e. Cephalic vein in the upper arm – proximal, mid, & distal.
- f. Basilic vein in the upper arm – proximal, mid, & distal.
- g. Focal symptomatic areas, if present.

Longitudinal grayscale, longitudinal color Doppler, and spectral Doppler images should be recorded of the following. Appropriate color technique should be utilized to demonstrate filling of the venous lumen. All spectral Doppler should be obtained in the long axis for evaluation of asymmetry or loss of cardiovascular pulsatility and respiratory phasicity:

- a. Bilateral internal jugular veins.
- b. Bilateral subclavian veins.
- c. Axillary vein of side(s) being evaluated.
- d. Mid brachial veins of side(s) being evaluated.
- e. Mid cephalic vein of side(s) being evaluated.
- f. Mid basilic vein of side(s) being evaluated.

- Forearm veins

Symptomatic areas such as the forearm generally require additional targeted evaluation and additional images if the cause of the symptoms is not readily elucidated by the standard examination. If the patient has focal symptoms at the forearm, complete evaluation of the basilic and cephalic veins should be performed to the wrist, in addition to sonographic evaluation of the area of focal symptoms, including of the radial and ulnar veins if appropriate. If questions, consult with Radiologist regarding indicated images.

- The extent and location of sites where the veins fail to compress completely should be clearly recorded and generally require additional images. If thrombus is suspected, it should be shown in gray-scale with compression (when possible), in longitudinal plane showing echogenicity and extent of thrombus, in longitudinal color flow to demonstrate complete vs. partial occlusion, and with spectral Doppler proximal to, in, and distal to the thrombus.
- Other vascular and nonvascular abnormalities, if found, should be recorded, but may require additional imaging for diagnosis or further characterization.