UPPER EXTREMITY PERIPHERAL VENOUS EVALUATION FOR DEEP VENOUS THROMBOSIS

POLICY: Upper extremity venous ultrasound will be performed with an order from a physician or other qualified clinical practitioner. The examination will be supervised and interpreted by a radiologist or other licensed practitioner who is qualified by reason of training to understand the normal anatomy, pathophysiology of the venous system, and integration of ultrasound with other imaging techniques to optimize the probability of detecting disease.

PURPOSE: To assess the venous anatomy of the upper extremity and neck for the detection of deep venous thrombosis (DVT).

INDICATIONS: Ultrasound of the upper extremity venous system is indicated for patients with signs, symptoms, and/or laboratory evidence of deep venous thrombosis. This examination is an appropriate study for patients with signs of possible venous obstruction or thrombus in symptomatic or high risk asymptomatic individuals, evaluation for deep-vein thrombosis (DVT) in patients with suspected pulmonary embolism, or follow up for patients with known venous thrombosis. Symptoms of venous thrombus include: arm/neck swelling, arm/neck pain, palpable “cord” in arm, infusion difficulty with indwelling venous catheters.

PATIENT PREPARATION: No prep needed.

PROCEDURE/TECHNIQUE: The patient is placed in the supine position. The patient’s arm can be abducted and rested on a towel or cushion that is positioned on the sonographer’s lap. The arm should not be elevated in relationship to the level of the heart. The overlying clavicle can make visualization of the vein difficult; abduction/adduction of the arm can change the location of the clavicle and allow visualization of the underlying anatomy. When scanning the left arm, the stretcher can be turned 180 degrees, and the sonographer can scan from the head of the bed.

Similar to lower extremity venous examinations, “proximal” and “distal” will be anatomically defined, not hemodynamically. Anatomically, in the upper extremities, “distal” refers to towards the fingers (oppositely, hemodynamically, “distal” veins are closer to the heart).

Some clarification in regards to anatomy should be addressed. The innominate or brachiocephalic (BCV) vein originates at the confluence of the subclavian and
IJV. The subclavian vein is a continuation of the axillary vein; the axillary vein is renamed subclavian vein as it crosses the 1st rib. This may be a difficult anatomical landmark to distinguish with ultrasound, due to the overlying clavicle. Therefore, sonographically, the clavicle will be used to distinguish axillary from subclavian veins. The supraclavicular segment of the vein will be referred to as subclavian and the infraclavicular segment will be referred to as axillary. Similarly the axillary vein is a continuation of the basilic vein; the basilic vein is renamed axillary vein as it crosses the lower border of the Teres major muscle. Again, this can be a difficult anatomical landmark to distinguish with ultrasound. Therefore, the confluence of the basilic with the brachial vein(s) will serve as the origin of the axillary vein.

Each venous segment should be evaluated in its entirety and representative compression, color Doppler and spectral Doppler images obtained. Although an attempt should be made to obtain the images as described below, it is recognized that this may at times be impossible when vessels are very small in diameter or are inaccessible, such as is often the case with the brachiocephalic veins. If a cephalic vein is small in diameter, a tourniquet technique may aid in dilating the vessel(s) for better visualization; compress the vein distally while imaging the vein proximally. Distal augmentation can be used as a technique to aid in demonstrating color filling a vessel. If it is technically too difficult to adequately demonstrate flow using color and/or spectral Doppler in a small upper extremity vein, then a compression view alone must suffice.

In addition to the representative images detailed below, any other specific areas of complaint should be investigated for superficial thrombus or other abnormality. Representative images are as follows (minimal number of images in parenthesis):

**B-MODE (11 cines)**
- Internal Jugular Vein (IJV) (1 cine)
- Axillary Vein (1 cine)
- Brachial Veins (2 cines)
- Basilic Vein (2 cines)
- Cephalic Vein (2 cines)
- Median Cubital Vein (MCV) (1 cine)
- Radial Veins (1 cine)
- Ulnar Veins (1 cine)

**COLOR/SPECTRAL DOPPLER (14 images)**
- Internal Jugular Vein (IJV) (1 color / 1 spectral image)
- Innominate Vein (1 color / 1 spectral image)
- Subclavian Vein (1 color / 1 spectral image)
- Axillary Vein (2 color / 2 spectral images)
- Brachial Veins (1 color image)
- Basilic Vein (1 color image)
B-MODE: Compression, using real-time imaging should be performed perpendicular to the vein axis, along the entire length of the vessel under examination, in an effort to completely oppose the venous walls. The brachiocephalic, subclavian and proximal axillary veins are difficult to compress because of their proximity to the clavicle. As a result, using compression as a technique to rule out thrombus does not apply to these vessels; rather, patency is determined by demonstrating flow using color/spectral Doppler. Representative cine sweeps should be captured, demonstrating compressibility of vein. In the presence of DVT, additional longitudinal b-mode images should be obtained, demonstrating the echogenic intraluminal thrombus.

Additional images may be required to fully document the findings.

Minimal stored images should include:

- One cine with compression of the IJV, labeled Rt or Lt IJV
- One cine with compression of the proximal cephalic vein near its confluence with the subclavian vein, labeled Rt or Lt Cephalic V Prox
- One cine with compression of the distal axillary vein, labeled Rt or Lt Axillary V Dist
- One cine with compression of the proximal brachial veins, labeled Rt or Lt Brach V Prox
- One cine with compression of the distal brachial veins, labeled Rt or Lt Brach V Dist
- One cine with compression of the proximal basilic vein, labeled Rt or Lt Basilic V Prox
- One cine with compression of the distal basilic vein, labeled Rt or Lt Basilic V Dist
- One cine with compression of the proximal cephalic vein, labeled Rt or Lt Cephalic V Dist
- One cine with compression of the MCV, labeled Rt or Lt MCV
- One cine with compression of the radial veins, labeled Rt or Lt Radial V
- One cine with compression of the ulnar veins, labeled Rt or Lt Ulnar V

COLOR/SPECTRAL DOPPLER: Doppler images should be obtained in a plane parallel to the length of the vein being investigated. The color Doppler pulse repetition frequency (PRF), gain and wall filter should be adjusted to identify slow flow along the vessel wall, while simultaneously minimizing color artifact in surrounding soft tissues. The Doppler spectrum should occupy 1/2 of the image format and the PRF optimized and baseline adjusted so that the venous
waveform occupies 2/3 of the velocity scale. The spectrum sweep should be adjusted to display at least two complete respiratory cycles. Normal flow should display characteristics of pulsatility and/or respiratory phasicity. Additional images may be required to fully document the findings.

- Minimal stored images should include:
  
  - One longitudinal color Doppler image of the IJV, labeled *Rt* or *Lt IJV*
  - One longitudinal spectral Doppler waveform of the IJV, labeled *Rt* or *Lt IJV*
  - One longitudinal color Doppler image of the innominate vein, labeled *Rt* or *Lt Innom V*
  - One longitudinal spectral Doppler waveform of the innominate vein, labeled *Rt* or *Lt Innom V*
  - One longitudinal color Doppler image of the subclavian vein (supraclavicular), labeled *Rt* or *Lt Subclavian V*
  - One longitudinal spectral Doppler waveform of the subclavian vein (supraclavicular), labeled *Rt* or *Lt Subclavian V*
  - One longitudinal color Doppler image of the proximal axillary vein (infraclavicular), labeled *Rt* or *Lt Axillary V Prox*
  - One longitudinal spectral Doppler waveform of the proximal axillary vein (infraclavicular), labeled *Rt* or *Lt Axillary V Prox*
  - One longitudinal color Doppler image of the proximal cephalic vein at its confluence with the axillary vein, labeled *Rt* or *Lt Cephalic V Prox*
  - One longitudinal color Doppler image of the distal axillary vein, labeled *Rt* or *Lt Axillary V Dist*
  - One longitudinal spectral Doppler waveform of the distal axillary vein, labeled *Rt* or *Lt Axillary V Dist*
  - One longitudinal color Doppler image of the brachial vein(s), labeled *Rt* or *Lt Brach V*
  - One longitudinal color Doppler image of the basilic vein in the upper arm, labeled *Rt* or *Lt Basilic V*
  - One longitudinal color Doppler image of the cephalic vein in the upper arm, labeled *Rt* or *Lt Cephalic V*

**PATHOLOGIC CONDITIONS**: When pathologic processes are detected during the course of the examination, extra images are necessary to characterize the abnormality. Lack of coaptation of any vein below the axilla, confirmed by absence of flow as shown with color Doppler, indicates intraluminal thrombus. Absence of flow in veins above the axilla suggests intraluminal thrombus; these veins are often dilated and lack wall motion in response to respiration. The presence of a filling defect, incomplete coaptation, and/or echogenic material
within the vein that moves in response to light transducer pressure may indicate a non-occlusive thrombus. Unilateral, monophasic, non-pulsatile spectral Doppler waveform characteristics suggest proximal obstruction. Flow characteristics vary from patient to patient; comparative evaluation of contralateral flow characteristics may aid with interpretation. Retrograde flow in the IJV and EJV may indicate a thrombosed ipsilateral brachiocephalic vein. If thrombus is present within the subclavian vein, innominate vein or IJV, then imaging of the contralateral side should be performed to evaluate for extension of the thrombus.

***The protocol outlined in this document was developed for Inland Imaging’s general ultrasound department and was modeled after the Inland Imaging Vascular Services written protocol:


References:


Additional Reference: