GUNDERSEN HEALTH SYSTEM ULTRASOUND DEPARTMENT POLICY AND PROCEDURE MANUAL

SUBJECT: **Lower Extremity Venous Ultrasound - DVT Exam**
SECTION: **Vascular Ultrasound**
ORIGINATOR: **Kraig Schuster**
REVISED DATE: March 22, 2018

APPROVED BY: _____
Jody Riherd MD

_____
Dave Clayton RDMS RVT

Prep: None.

Patient Position: Supine, reverse Trendelenburg position with patient head elevated 10-20 degrees.

Equipment: Colorflow duplex ultrasound unit with 5 MHz linear transducer. A 7 MHz linear transducer may be used for superficial imaging. *****Procedure should be performed at the lowest possible power settings.**

Objective: Evaluation of the lower extremity for deep venous thrombosis.

Exam Protocol: Bilateral lower extremities should be examined except in the circumstances where there are unilateral signs and symptoms. The calf veins should always be examined in a symptomatic lower extremity. In the setting of possible pulmonary embolus, post trauma screening, and/or screening for prolonged bed rest the calf veins are not evaluated unless the extremity is symptomatic. The lower extremity venous ultrasound exam for DVT consists of three major components:

1. Gray scale imaging of the thigh and knee veins.
2. Colorflow and spectral Doppler waveform analysis of the thigh and knee deep venous system.
3. Color Doppler imaging and transverse compression of the calf veins.

Gray Scale Imaging of the Thigh and Knee Veins:
Scanning with a transverse orientation, the distal CFV is located at the inguinal ligament. The vein is compressed with moderate probe pressure. The vein is observed to compress completely and the reopen as pressure is released. Compression technique is repeated every one to two cm distally through out the entire CFV, FV, and proximal greater Saphenous vein. The hip is externally rotated and the popliteal vein is evaluated with transverse compression from the posterior approach. Compression of the normal vein completely collapses the venous lumen, while DVT prevents vein wall coaptation.

Spectral Doppler Waveform Analysis of the Knee and Thigh Veins:
The transducer is placed in a longitudinal orientation and the cephalad CFV is located at the inguinal ligament. The Doppler cursor is placed in the center of the CFV and a spectral waveform is obtained. Venous flow is evaluated for spontaneity and respiratory phasicity. If spontaneity and respiratory phasicity are absent, Valsalva and distal augmentation should be documented. The CFV, FV, and Popliteal veins are also evaluated with spectral waveform analysis. In unilateral exams the contralateral CFV is also evaluated with spectral waveform analysis for comparison.

Calf Veins:

The deep veins of the calf are evaluated with colorflow Doppler and transverse probe compression. Spontaneous flow in the calf veins is very slow and color Doppler parameters need to be adjusted for this. Calf veins may best be imaged when the leg is placed over the side of the cart with the patient's foot resting on the sonographer's knee. Distal augmentation is usually necessary for detection of flow. The PTV and Peroneal veins are best imaged on the medial aspect of the calf. The ATV's (and sometimes the peroneal veins) are imaged on the lateral aspect of the calf. Any area of pain should be imaged for superficial or muscular vein clot.

Imaging Protocol:

Abnormal vessels and anatomic variants (such as duplicate vessels) may require additional images and will be noted on the work sheet. ***Please make note to use same size spectral Doppler scale for both CFV spectral Doppler images.**

Contralateral CFV*** with angle-corrected spectral Doppler showing respiratory variation – include the junction with the GSV in this image
Ipsilateral CFV*** with angle-corrected spectral Doppler showing respiratory variation – include the junction with the GSV in this image
Transverse compression and noncompression dual image CFV
Transverse compression and noncompression dual image CFV/GSV junction
Transverse compression and noncompression dual image proximal FV
Transverse compression and noncompression dual image mid FV
Transverse compression and noncompression dual image distal FV
Transverse compression and noncompression dual image popliteal vein
Proximal FV with color Doppler and spectral tracing and include color Doppler of the proximal profunda vein in this image
Mid FV with color Doppler and spectral tracing
Distal FV with color Doppler and spectral tracing
Popliteal vein with color Doppler and spectral tracing
Longitudinal proximal PTV/Per V with colorflow
Longitudinal distal PTV/Per V with colorflow
Longitudinal mid ATV with colorflow

***If superficial thrombus is noted a side by side compression image as well a color image to document thrombus should be taken.**

Bilateral exams will include all the above images on both legs; right leg first, then left leg. The image order for bilateral exams should start with the compression images first followed by the color/spectral Doppler images.

The American College of Chest Physicians suggests anticoagulation over no anticoagulation for patients with lower extremity superficial thrombophlebitis that are at **increased risk** for thromboembolism. For imaging purposes an increased risk is diagnosed by an affected venous segment ≥5 cm in length or in proximity ≤5 cm to the deep venous system.

Therefore our imaging protocol will change as follows regarding superficial thrombus: If there is clot in the GSV, LSV or Ant Tributary, measure the length of clot and distance from the deep system. If clot is in a branch, a varicose vein, or if GSV/LSV is tortuous, the length of clot is not attempted – only the distance from the deep system is measured if possible in these instances.

This was reviewed with Dr. Zlabek, chair of Vascular Medicine.

Diagnostic Criteria for Lower Extremity Venous Ultrasound
DVT Exam

Criteria for Vein Patency:

1. Veins completely coapt vein walls with moderate transducer pressure.
2. Normal venous Doppler signals of spontaneity, respiratory variation, and augmentation.

Criteria for Venous Thrombus:

1. Inability to completely coapt vein walls with moderate transducer pressure.
2. Abnormal venous Doppler signals. Loss of respiratory variation suggests either proximal DVT or proximal venous compression. Loss of augmentation suggests distal DVT. Spontaneity and respiratory variation may not be present in normal calf veins.

Acute vs. Chronic DVT:

Acute DVT:

1. Inability to completely coapt vein walls with moderate transducer pressure.
2. Distention of the vein with clot.
3. Free floating thrombus. Clot that has not adhered to the vein wall is almost always acute.
4. Venous flow around the thrombus.

Chronic DVT:

1. Thicker, irregular, and more echogenic vein walls.
2. Small vein caliber, often smaller than the adjacent artery.
3. Venous flow through the center of the vessel.
4. Presence of venous collaterals.
5. Valvular reflux.

1. Rose SC, Zwiebel WJ, Nelson BD, et al. Symptomatic Lower Extremity DVT: Accuracy, Limitations, and Role of Color Duplex RAD 1990:175; 639
2. Yucel EK, Fisher JS, Egglin TK, et al. Isolated Calf Venous Thrombosis: Diagnosis with Compression Ultrasound RAD 1991:179:443
3. Daigle R: Venous Colorflow Duplex Imaging of the Lower Extremities. *In* Program Supplement US: The Basics in Vascular Ultrasound July 31 and August 19, 1997 pp10-23. TIP-TV 1997, General Electric Company.
4. Zwiebel WJ: Venous Thrombosis and other Pathology. *In* Zwiebel WJ (ed): Introduction to Vascular Ultrasonography, 3rd ed. 1992, pp 305-321
5. Cronan JJ: Venous Thromboembolic Disease: The Role of US. RAD 1993; 186:619-630.

COLOR DUPLEX VENOUS ULTRASOUND OF LOWER EXTREMITIES FOR DVT

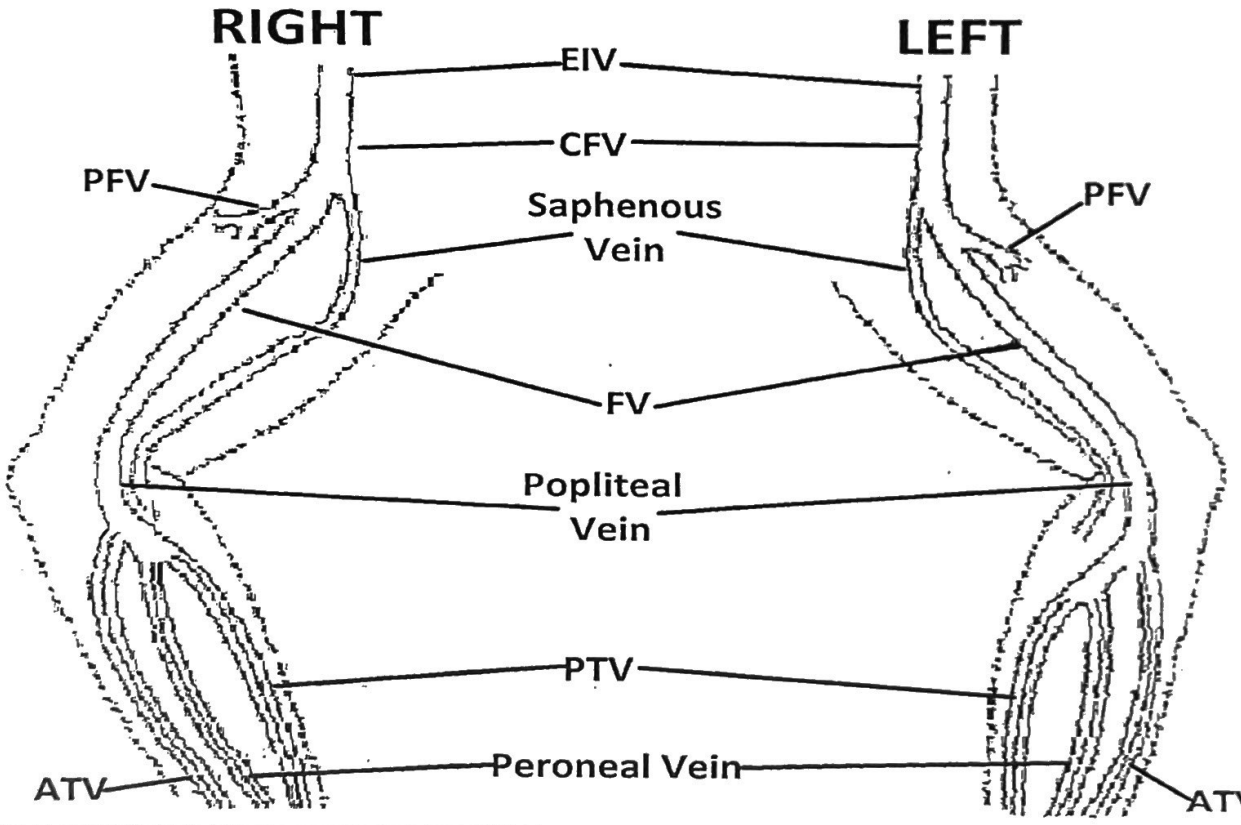
Name: _____ MRN: _____ Date: _____

Side Examined: RT_____ LT_____ Prior Venous US: Yes_____ No_____

Indication: _____

	RIGHT		LEFT	
	NL	ABN	NL	ABN
Compression (Thigh and knee area)				
Compression (Calf area)				
Spectral/Color Analysis				

COMMENTS:



IMPRESSION: _____ Sonographer _____