UCSF ED Point-of-Care Lower Extremity Vascular Ultrasound Protocol

Indications: Suspected DVT, PE

Anatomy:

1) The External Iliac Artery and Vein pass beneath the inguinal ligament and emerge as the Common Femoral Artery (CFA) and Common Femoral Vein (CFV), with the vein medial ("CVA" = Crotch, Vein, Artery).

2) The CFA bifurcates into the Superficial Femoral Artery (SFA) and Profunda Femoris Artery (PFA) about 2-3cm below this point.

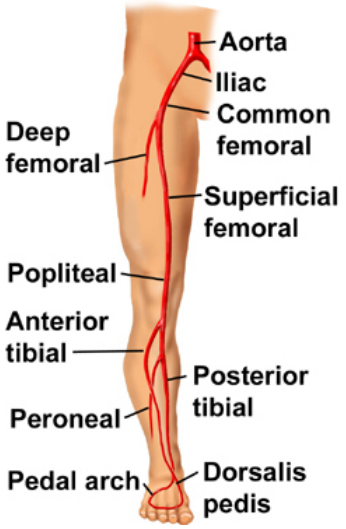
3) At about that same level, the Greater Saphenous Vein (GSV) empties into the CFV at the Saphno-Femoral Junction (SFJ) from the medial side.

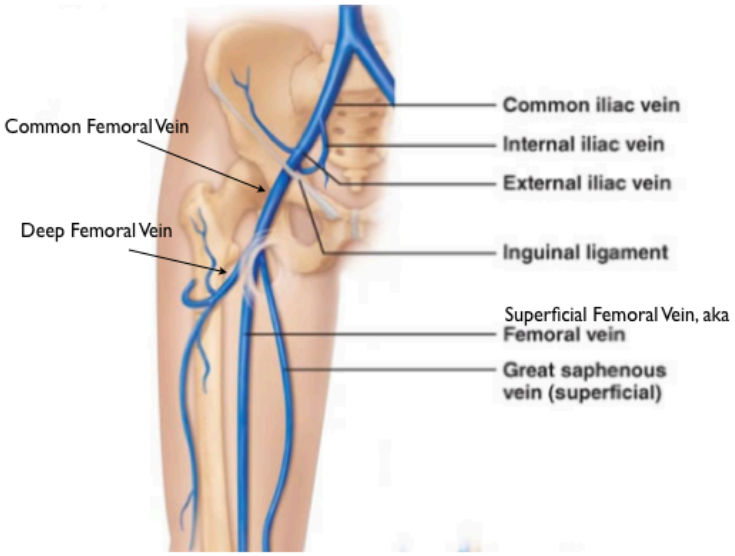
4) Just distal to this, the CFV splits into the Superficial Femoral Vein (SFV) and the Deep Femoral Vein (DFV).

5) Both the PFA and the DFV dive deep (and lateral) into the thigh after splitting off. You won't see them on ultrasound after this point.

6) The SFA and SFV continue together down the thigh and, after diving through the adductor hiatus, emerge as the popliteal artery (PA) and vein (PV).

*__Note that the SFV is a deep vein, not a superficial one__. It's the main deep vein of the upper leg, and a clot in this vessel is absolutely 100% a DVT. Confusion over this nomenclature has led UCSF Radiology to advocate for re-naming the SFV the "Femoral Vein" (FV) instead, although this is not universal outside of this institution. In our ED, SFV or FV is OK. Note that the SFA is <u>never</u> called the "Femoral Artery," however.





Patient Positioning: The hip should be slightly flexed + externally rotated and the knee flexed at about 20-30 deg to allow the best exposure of the common, deep, and superficial femoral veins as well as the popliteal fossa. Note transducer position below for examining 1: Common (CFV), deep (DFV) and proximal superficial femoral vein (SFV), and 2: the popliteal vein (Pop V).

1) Patient positioning

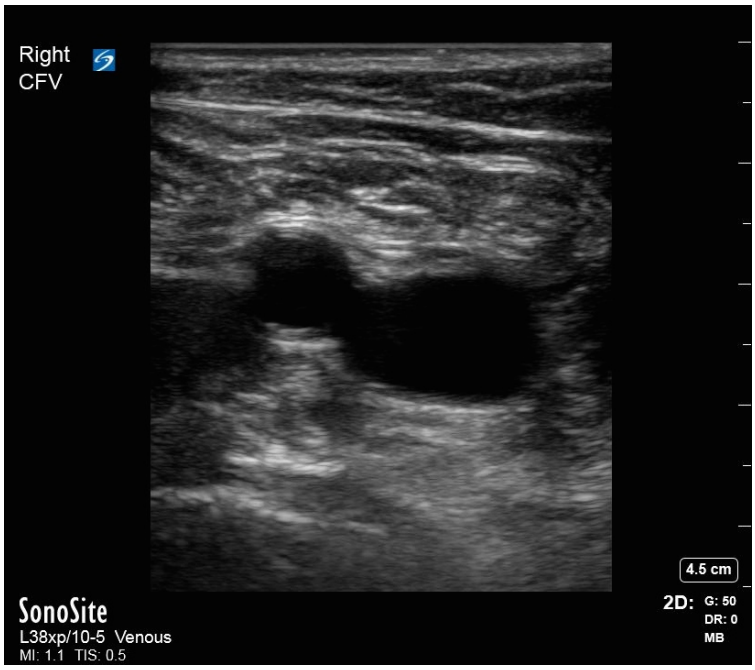
2) Patient positioning.

Transducer Selection: For most patients, the high-frequency 10-5Mhz linear array transducer should be used, however for larger patients it may be necessary to use the lower frequency 5-2Mhz curvilinear probe. The probe marker should face to the patient's right side or toward the head in order to obtain a standard orientation.

Compression technique: At each point described below, apply firm, downward pressure to achieve complete collapse of the vein. The lumen of the vein should disappear in order to exclude the presence of a clot.

Scanning Protocol:

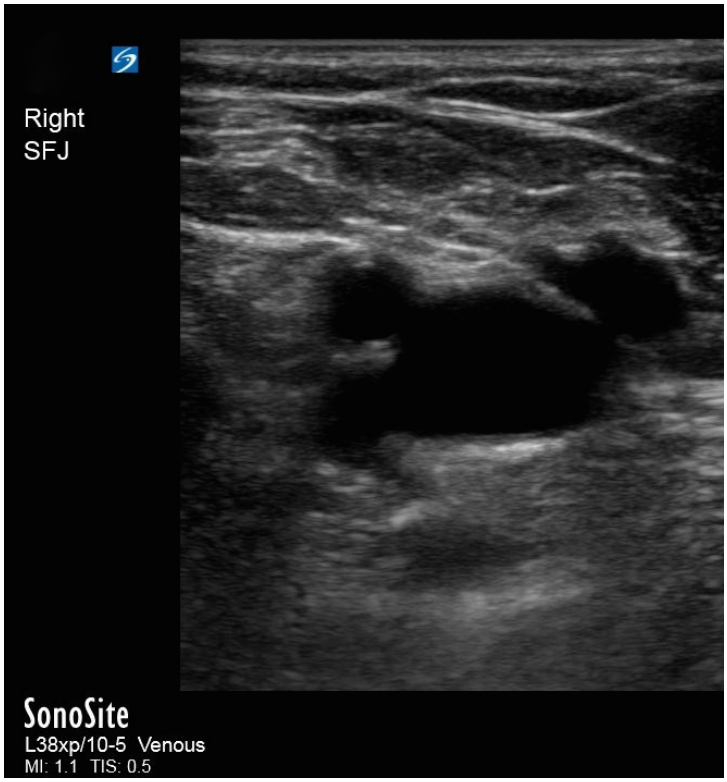
1) Clip #1 should be at the level of the CFV above the sapheno-femoral junction. Hold the transducer in a transverse position, as perpendicular to the skin surface as possible. Start the examination as proximally as possible, ideally just distal to the inguinal ligament. Don't be shy. You will need to get very close to the groin in order to adequately visualize the CFV. You will see the CFA just lateral to the vein and the femoral nerve just lateral to that. Note the echogenic cortex of the head of the femur below the vessels. **Make sure to label "CFV" as shown below**.



Without Compression

With Compression

2) Clip #2 should be at the level of the CFV at the sapheno-femoral junction. Once the CFV and common femoral artery (CFA) are identified, move distally until the greater saphenous vein (GSV) is seen emptying into the CFV. Compress the CFV and GSV. The CFA will have bifurcated into the Superficial Femoral Artery (SFA) and Deep Femoral aka Profunda Femoris Artery (PFA).



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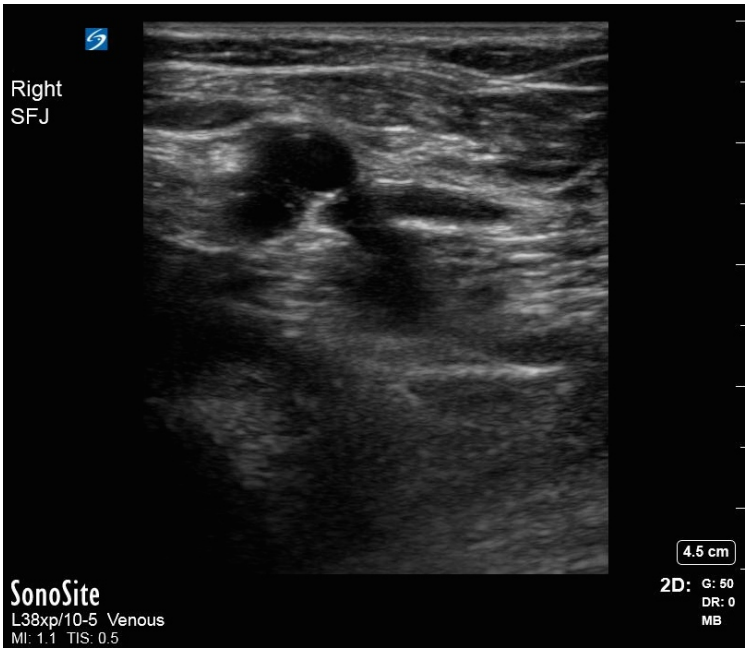

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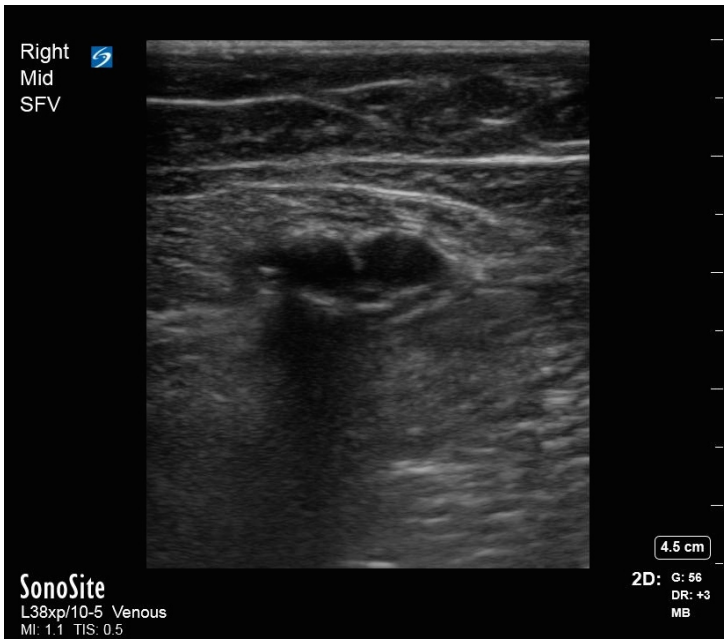
3) Clip #3 should be a last look at the CFV just below the saphno-femoral junction. Image will appear similar to the above, possible with a view of the CFV splitting into the SFV and Deep Femoral Vein (DFV).

4) Clip #4 should be at the level of the proximal SFV. Move down the leg 2-3cm. At this point, the CFV will have split into the SFV and Deep Femoral Vein as noted above, although this bifurcation is sometimes not visualized well. The DFA will have also disappeared. You will now see just 2 adjacent vessels: the SFA and SFV. The artery is usually lateral and superficial) to the SFV. **Change label to "SFV."**



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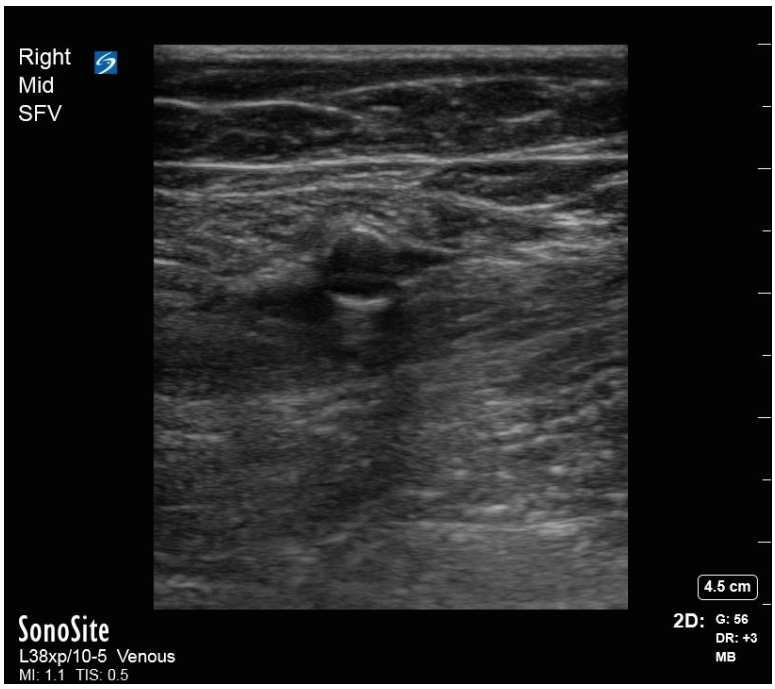

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5) Clip #5 should be at the level of the mid SFV. Image will appear similar to above.

6) Clip #6 should be at the level of the distal SFV. Image will appear similar to above.

7) Clip #7 should be at the proximal popliteal vein. Place the probe in the popliteal fossa and compress. Take care to differentiate the popliteal vessels from the muscular calf veins seen more superficially. They will be the deepest vessels, just above the joint, and appear as a "2-light traffic light" as seen in the middle of the screen below. **Change label to "Pop."**

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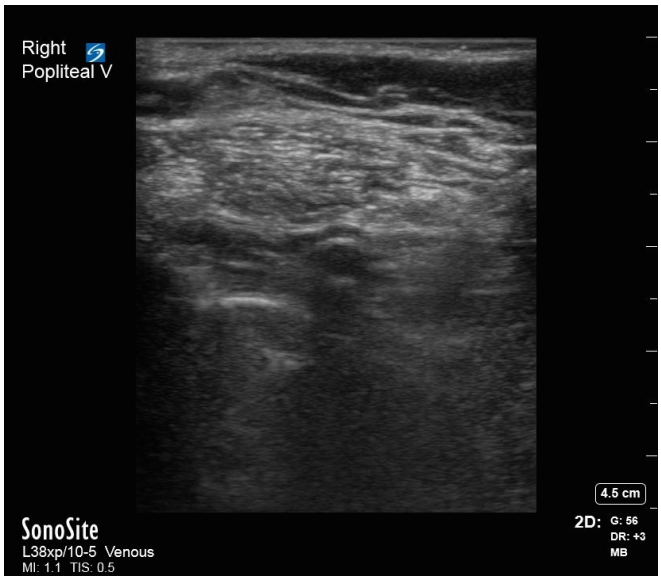
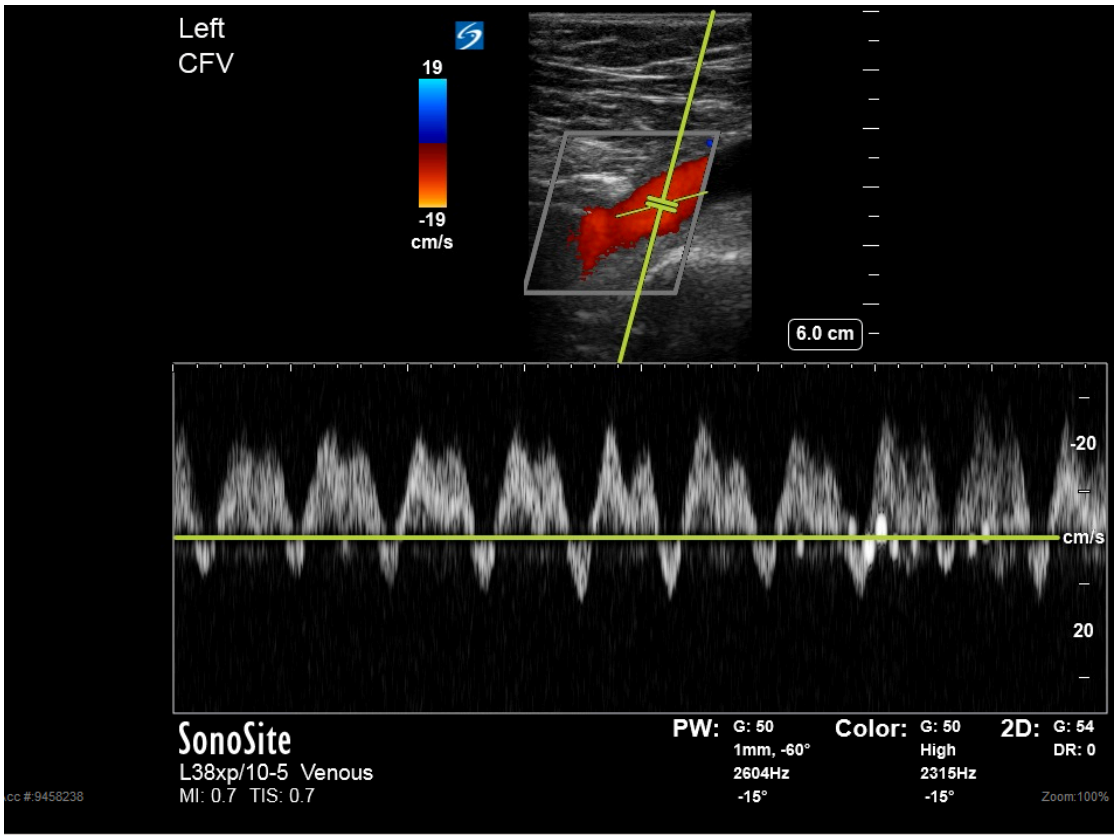
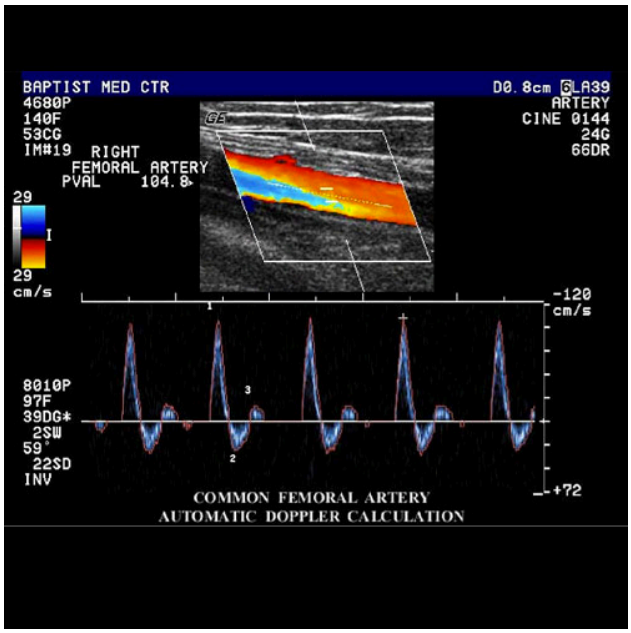


With Compression

<u>Recommended: Doppler Waveform Analysis</u>

8) Image #8 should be a still image of the venous waveform of the CFV just proximal to the SFV. Turn the transducer 90 deg cephalad to obtain a view of the CFV in a longitudinal orientation. Adjust color Doppler scale and use steering and angle correction features to obtain a tracing to the venous waveform using pulsed Doppler. Note that the waveform will appear "pulsatile" because of the central venous pressure changes in response to the cardiac cycle (remember the a, c, and y waves, x-decent, etc? Don't worry about those details but realize that you should not see a static flow velocity). Also note that you will see respiratory phasicity in normal patients.





In comparison, note the different shape and much higher velocities (120 vs 20 cm/sec) in the adjacent artery

9) Image #9 should be a still image of the venous waveform of the proximal or mid SFV. Use same technique as #7 above.

10) Image #10 should be a still image of the venous waveform of the popliteal vein. Use same technique as #7 above.