

Deep Vein Thrombosis

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Among the various imaging modalities to assess patients presenting with signs and symptoms of deep vein thrombosis, bedside ultrasound is an excellent starting point.

Point-of-care (POC) ultrasound for the evaluation of deep vein thrombosis (DVT) is a two-region compression examination evaluating for clot in the femoral and popliteal regions. To begin the study, the clinician should place the high-frequency linear probe just distal and parallel to the inguinal ligament in a transverse orientation relative to the underlying vessels. Regarding proper positioning, the patient's knees should be slightly flexed and the hip externally rotated when performing the examination (**Figure 1**). If there are any issues in visualization, the clinician should attempt to maximize depth by moving the probe medially. To ensure patient and clinician comfort, the patient should be appropriately draped prior to the examination.

Femoral and Saphenous Vein

After the appropriate positioning has been achieved, the clinician should identify the common femoral vein and artery, and then slide the probe toward the head or feet until the saphenous vein, which empties into the common femoral vein, is identified (**Figure 2**). This area can be a nidus for clot formation and must be thoroughly evaluated to ensure a complete study.

The clinician should take care not to apply too much pressure with the probe as this will compress the saphenous vein; therefore, it is important to use a light touch to ensure proper visualization. Once this key region is identified, the clinician should then use the probe to apply pressure to the vessels. The saphenous vein should

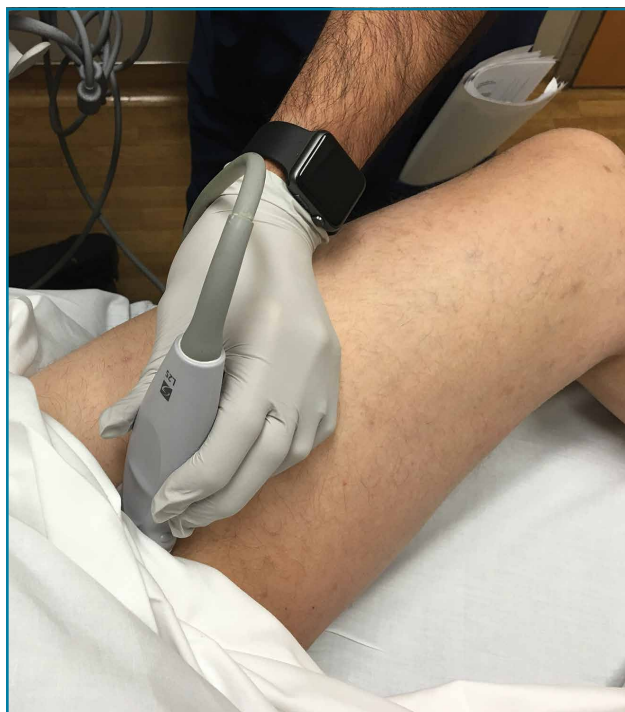


Figure 1. Photograph demonstrating appropriate patient positioning during ultrasound evaluation of the femoral region for deep vein thrombosis

compress completely upon application of sufficient pressure to the artery. In a normal vein, the anterior and posterior walls should touch and completely obliterate

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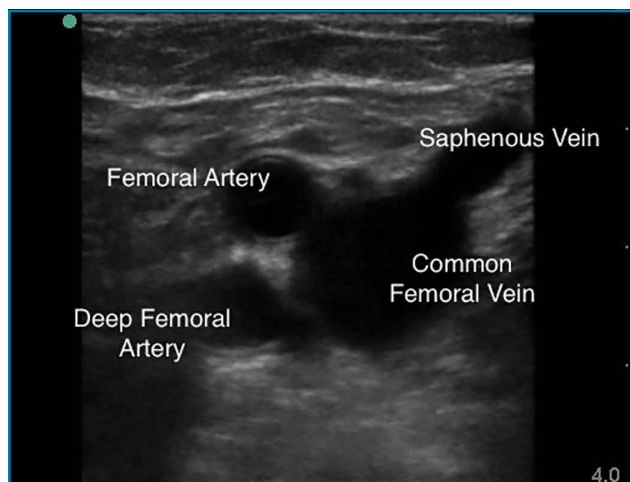


Figure 2. Ultrasound image visualizing the femoral and deep femoral arteries and the saphenous and common femoral veins



Figure 4. Photograph demonstrating appropriate patient positioning during ultrasound evaluation of the popliteal fossa

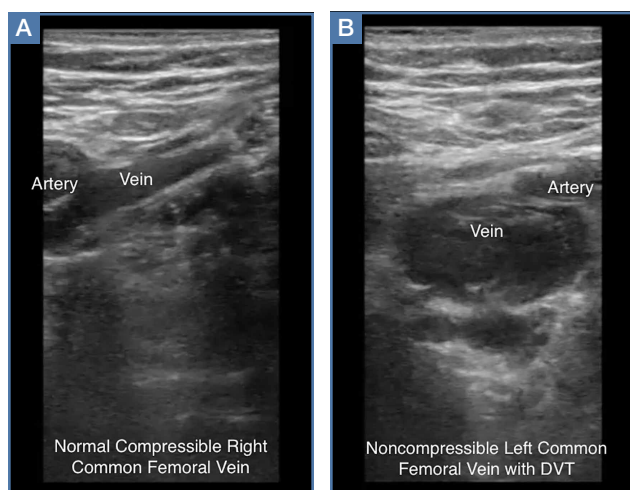


Figure 3. Ultrasound images showing a normal compressible right common femoral vein (A) and a noncompressible left common femoral vein, indicating deep vein thrombosis (B)

the lumen of the vein. When a clot is present, the walls of the vein will remain separated (**Figure 3**). A thrombus can be bright on ultrasound, but some DVTs may appear completely black. In some cases, a lack of compressibility may be the only tip-off to the presence of clot.

After fully evaluating the saphenous vein, the clinician should move the probe toward the feet, keeping the vessels centered in the image, while at the same time applying serial compression approximately every centimeter. As the probe is moved distally, the artery will typically bifurcate first and then the vein will bifurcate into the femoral and deep femoral branches.

The femoral vein should be followed until it “dives” into the adductor canal.

Popliteal Region

The second zone of the examination is in the popliteal region. It can be helpful to prop the foot up, or hang the foot off the bed to improve access to this region (**Figure 4**). Similar to the femoral region, maximizing your depth and then decreasing it once the vessels are identified can help to ensure that you are not mistaking superficial vessels for the popliteal artery and vein. The field of view is adequate when the underlying bone is visualized on the image. Typically, the popliteal vein will be just superficial to the artery (**Figure 5**). Once the vessels have been identified, they should be traced back proximally to the first point they are visualized in the popliteal fossa. From this starting point, it is important that the clinician apply serial compression distally until the vessel trifurcates.

Common Pitfalls

The main pitfall to performing a DVT study is failing to identify the correct vessels. It is important to identify both the artery and vein running together to ensure that the correct location. In larger patients, the relatively shallow depth of the high-frequency probe may be inadequate limiting the ability to obtain adequate images.

Another common pitfall to keep in mind is that lymph nodes can often be mistaken for clot (**Figure 6**). A lymph node may be distinguished from a clot by sliding the probe up and down the patient’s leg—lymph nodes will appear as discrete structures, continuous like vascula-

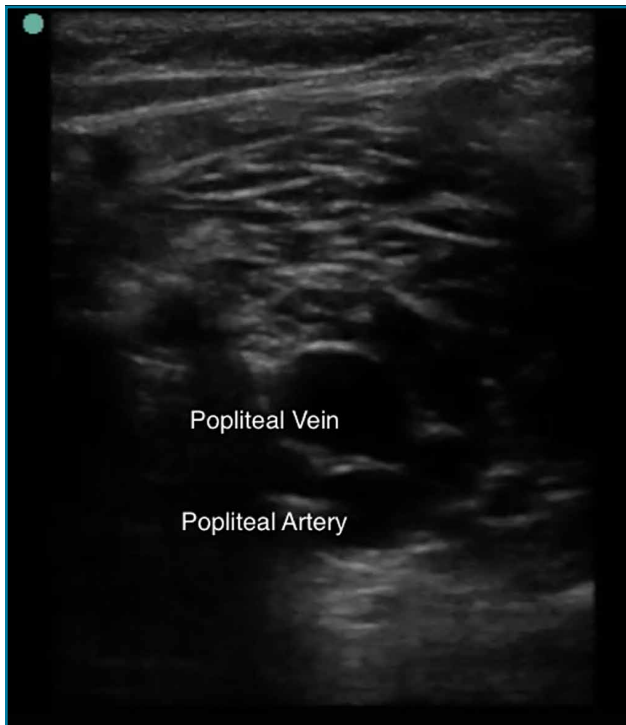


Figure 5. Ultrasound imaging showing the popliteal vein and artery

ture. It is essential to evaluate the length of the common femoral, the femoral, and popliteal veins visualized as a recent study by Adhikari et al¹ showed that two-point compression studies can miss up to 6% of isolated clots.

Summary

With practice, POC compression ultrasonography of the lower extremities can be used to quickly rule in the diagnosis DVT. Proper patient and probe positioning, as



Figure 6. Ultrasound imaging demonstrating the appearance of a lymph node, which can sometimes be mistaken as a thrombus

well as the application of appropriate probe pressure at different stages of the examination are essential to accurately visualize and assess the femoral, saphenous, and popliteal veins for the presence of a thrombus.

Reference

1. Adhikari S, Zeger W, Thom C, Fields JM. Isolated deep venous thrombosis: implications for 2-point compression ultrasonography of the lower extremity. *Ann Emerg Med.* 2015;66(3):262-266.

For a video and more information on performing this scan: <http://www.em.emory.edu/ultrasound/ImageWeek/Soft%20Tissue/Femoral%20DVT.html>.