

## **Deep Venous Thrombosis Supporting Literature:**

*Emergent Question:* Is the common femoral or popliteal vein fully compressible?

*Probe Type:* Vascular probe (linear array, high frequency); 7.5 - 10 MhZ

*Critical Care Scenario:* Patients who are unable to be transferred to radiological suites for evaluation of pulmonary embolism may benefit from evaluation of lower extremity deep veins. Also patients who are in acute resuscitation, finding a deep vein thrombosis may provide the clinician with more confidence in making the decision for heparin or intra-arrest thrombolytic agents.

*Scanning Technique:* Most patients in the emergent setting will be unable to sit in the best position to evaluate the lower extremity veins (with legs hanging off the bed). Most patients are supine and the visualization of the deep veins of the lower extremity can be improved by externally rotating the leg. The probe marker should be directed towards the patient's right side. If the veins are collapsible with pressure, the vein is patent and there is no clot present. If the veins do not collapse with pressure, there may be a clot within the lumen of the vessel preventing collapse. If the artery is seen in relationship to the vein (which is preferred), the amount of pressure applied should be even and just enough show some small deformity in the artery visualized. The strength and direction of compression is important since if not done strong enough, one might think there is a thrombus when there is not, and if done too aggressively one might miss early thrombi formation that is not clearly seen in the lumen of the vessel. Also, the pressure should be applied evenly and perpendicular to the skin, if pressure applied at angle, the vessel may appear not to collapse. The most common examinations are the 'two point' and the 'three point' studies, where two point examination studies the common femoral vein and the popliteal vein; and the three point examination adds the superficial femoral vein. The two point examination has been well validated in the outpatient population [1-3]. The three point examination is recommended as there have been studies that show higher incidence of clots isolated to the superficial femoral vein in asymptomatic patients [4, 5]. In a study by Kory et al, they found their sensitivity would have decreased from 88% to 82% if the superficial femoral vein was not included; and as a result they recommend a three point protocol [6]. The common femoral vein should compress fully and done at the greater saphenous takeoff [Figure 1]. Then you can move just a bit distal to image the deep/superficial femoral vein junction. The last location to evaluate is the popliteal vein behind the knee. In the supine patient, the operator can lift the leg and place the probe behind the knee. One must not mistake the lymph node for a clotted femoral vein, and can be best prevented by scanning proximal and distal or turning your probe to the longitudinal axis, as a lymph node will not continue in either direction more than a few centimeters and appears as a circular structure in longitudinal views [Figure 2].

*Supporting Literature:* Venous thromboembolism has been shown to lead to significant morbidity and mortality when undiagnosed in the emergently ill patient [7-9]. It has also been shown that clinicians with focused training in ultrasound can perform accurate proximal lower

extremity deep vein studies, with a study from Blaivas et al showing that emergency medicine physicians with 5 hours of training achieved a 98% agreement with formal ultrasound [10-12]. Most studies done on this topic had examinations that were limited to the proximal veins secondary to the undefined clinical relevance of calf vein thrombosis in the intensive care units, the much lower sensitivity of ultrasound to diagnose calf deep vein thrombosis, and the increased time this would require [13, 14].

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Figure 1 - common femoral at greater saphenous (1a), superficial femoral (1b), popliteal (1c)

Figure 2 - lymph node (2a) and deep vein thrombosis (2b) in comparison