Recent trends in diagnosing deep venous thrombosis

I was trained as a physician in Russia, and worked for some years as a cardiologist. When I came to the United States I did not seek licensing as a physician, instead I worked for a time as a diagnostic medical sonographer before becoming a medical writer.

I have worked in hospitals with policies permitting calling in a sonographer to test for the deep venous thrombosis without calling a licensed physician to interpret the test. The question I am answering in this essay is the diagnostic value of ultrasound testing for the deep venous thrombosis (DVT). I define ultrasound testing as 2-dimension echosonography and Doppler sonography. Should a licensed physician ultimately rule out deep venous thrombosis based on a negative ultrasound test result only?

To understand diagnostic value of the testing, we should understand the diagnoses of deep venous thrombosis. Deep venous thrombosis occurs when a blood clot is formed in one of the large veins, most often in the lower extremities, which leads to partial or complete blockage of blood circulation.

Pulmonary embolism occurs when a fragment of blood clot breaks off the wall of the vein and migrates to the lungs, where it blocks a pulmonary artery or one of its branches.

Every year in the United States from 200,000 to 600,000 humans are diagnosed with deep venous thrombosis and pulmonary embolism (collectively known as a venous thromboembolism). Pulmonary embolism is the most dangerous complication of deep venous thrombosis. Deep venous thrombosis occurs when a blood clot is formed in one of the large veins, most often in the lower extremities, which leads to partial or complete blockage of blood circulation.

Pulmonary embolism is up to 25% higher in Americans whose heritage is African compared with Americans of European heritage. Incidence is lower in Americans with Asian, Pacific Islander, and Hispanic ancestry. The report of higher risk for deep venous thrombosis in descendants of Africans may be associated with a higher level of hematicotrophic markers, such as factor VIII, von Willebrand factor, and D-dimer. These factors are lower in Americans of Chinese ancestry. 

Several diagnostic methods can detect deep venous thrombosis: Wells clinical probability score, D-dimer, plethysmography and rheography, ultrasound, magnetic resonance imaging (MRI), computed tomography (CT). However, ultrasound diagnostics is considered the most clinically effective method. According to 1 report, ultrasound has 94% sensitivity for proximal deep venous thrombosis, with 64% sensitivity for distal deep venous thrombosis, and 94% specificity. Another study suggests that ultrasound has only 70% sensitivity, but 100% specificity for deep venous thrombosis.

The meta-analysis of 31 diagnostic algorithms used in the United Kingdom suggested that Wells clinical probability score can be used mostly for detection of proximal deep venous thrombosis in all risk categories. However, a Danish group of 193 pre-surgical patients with new diagnosis of the colorectal cancer estimated that combined use of clinical probability score and D-dimer can exclude the deep venous thrombosis with the negative predictive value of 99% (95% CI), positive predictive value 17% (CI 95%), sensitivity 93% (95%), and specificity to 61% (95% CI) in patients, before the surgery. Despite variations between assays and population, D-dimer has 91% sensitivity and 55% specificity for deep venous thrombosis in symptomatic patients. The study described in the New England Journal of Medicine in 2003 suggested that ultrasound could be safely omitted for patients with low clinical probability of deep venous thrombosis and negative D-dimer; the study reported 1.7 times reduction (P=0.008) of the ultrasound use due to D-dimer testing.
the 2008 Swedish study of 328 patients with normal D-dimer, which concluded that a combination of a normal Wells clinical probability score and normal D-dimer excludes diagnosis of deep vein.(7) The meta-analysis of the value of plethysmography/rheography/phleborheography for deep venous thrombosis diagnosis in 78 studies, where mean sensitivity was 84.6% and mean specificity was 85.2% (95% CI), concluded that neither plethysmography, nor rheography alone are sufficient for deep venous thrombosis diagnosis. The other meta-analysis study estimated that plethysmography and rheography techniques have modest specificity, and modest sensitivity for proximal deep venous thrombosis and low sensitivity for distal deep venous thrombosis.(3) CT scanning reported to have 95% sensitivity for both proximal and distal deep venous thrombosis and 97% specificity.(3) In patients with clinically suspected PE sensitivity of CT ranged from 71% to 100% and specificity of ranged from 93% to 100% and was similar to sensitivity and specificity of ultrasound in patients with suspected PE.(9) In ICU patients CT venography had 70% sensitivity and 96% specificity in diagnosing DEEP VENOUS THROMBOSIS that suggested use of the indirect CT venography as an alternative to sonography in the ICU population.(4)

The pooled estimate of MRI sensitivity at 92% (95% CI) and the pooled estimate of MRI specificity at 95% (95% CI) suggested that MRI has sensitivity and specificity comparable to ultrasound in the deep venous thrombosis diagnostics.(3,10) In addition, the sensitivity and specificity for deep venous thrombosis detection by MRI were 100% for iliac and popliteal segments, 100% for femoral, and 98% for below-the-knee veins, which means that MR venography has a higher potential than ultrasound to diagnose deep venous thrombosis in the iliac, femoral, popliteal, and calf muscle veins.(11) There are studies suggesting that the algorithm for diagnosis, which includes ultrasound testing, is clinically- and cost-effective, but Wells clinical probability score and D-dimer testing are less expensive, and CT- and MR-venography have equal to, or better than the capability of ultrasound for diagnosis.

References

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