# Decision Analysis of Thermography and Venography in the Diagnosis of Deep Vein Thrombosis: Part 1

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•Deep vein thrombosis is a common disorder that often results in pulmonary embolism and chronic venous disease. Several technologic alternatives to contrast medium venography have been proposed to make treatment decisions in patients with clinically suspected deep vein thrombosis. Thermography is an imaging technique that is relatively sensitive to the presence of deep vein thrombosis of both thigh and leg, and is therefore proposed as a first-line screening test.

Decision analysis is a formal evaluation tool that assigns quantitative values to event probabilities and associated outcomes. Decision analysis allows medical policy makers to examine alternative diagnostic and therapeutic strategies in an explicit and logical manner. Sensitivity analyses are performed to determine how changes in soft data can influence the policy decisions.

The decision analysis model evaluated here considers three initial approaches: (A) Empirically treat all patients with anticoagulation without prior testing; (B) Order venography, and treat only those patients with positive results; and (C) order thermography, do *not* treat patients with *negative* results, and perform confirmatory venography in patients with positive thermography results. Results of this decision analysis suggest:

1. A physician caring for a patient with findings suggestive of deep vein thrombosis should opt for either venography or thermography, rather than empiric anticoagulation.

2. The decision between venography and thermography is *extremely* sensitive to the usual range of outcome probabilities and the prevalence of deep vein thrombosis.

3. Individual patient utilities for disease morbidity, and for the side effects of anticoagulation and venography, may influence specific situations if all other variables are known, but in terms of policy decisions, the uncertainty in #2 overwhelms utility considerations.

4. Based on the above, the diagnostic decision should be made on the basis of cost effectiveness.

Pulmonary embolism is the commonest preventable cause of hospital death, and about 50% of these cases have preceding evidence of deep vein thrombosis (DVT).[1] In addition, DVT itself is associated with significant acute and chronic morbidity. Unfortunately, clinical examination for DVT is associated with a false positive rate of about 50%, so that routine empiric administration of systemic anticoagulation to all persons suspect clinically would result in excessive morbidity[2] and cost.[3,4]

Contrast medium venography is the currently accepted diagnostic "gold standard" for the diagnosis of DVT. However, segmental nonvisualization of thrombosed veins (a false negative result) occurs in 10–30% of studies performed in major medical centers. In addition, false positive reports result from flow defects caused by streaming of nonopacified blood. In fact, venography is considered to have an overall accuracy for DVT of only about 90%[4,5] compared with surgical and post-mortem findings; in the absence of a better test, however, treatment decisions continue to be based on the venographic report.

Venography is expensive,[3] and is associated with a significant incidence of pain, skin necrosis, precipitation of a venous thrombosis syndrome, anaphylactoid reaction, and damage to the kidneys.[6] Furthermore, technical adequacy[7] requires that all veins be visualized, which may require as much as 150 ml of contrast material and fluoroscopic manipulation by the radiologist.

Several alternative, noninvasive technologic approaches have been developed to make treatment decisions in patients with clinically suspected deep vein thrombosis. Impedance plethysmography (IPG), extensively studied by Hull and associates,[3,8,9] is about 95% sensitive to the presence of *proximal* (popliteal and thigh) DVT, but insensitive ( <20%) to *distal* (leg) DVT. Hull[3] performed a cost effectiveness analysis and found that the combination of IPG and radiofibrinogen (the latter being 90% sensitive to leg DVT, but nonspecific for proximal thromboses) could be clinically efficacious, but its cost effectiveness compared to venography–only depended upon particular hospital accounting schedules. The IPG-RFB combination is, in fact, impractical: RFB requires several days for completion, and many centers have abandoned IPG because of its technical stringency as compared to real-time ultrasound.

Ultrasonic B–mode real–time scanning (USB) of the deep veins has gained popularity and is replacing IPG at many institutions; the sparse literature published to date suggests that, like IPG, USB is very sensitive to proximal but not distal DVT.

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