The value of colour duplex imaging in suspected proximal deep vein thrombosis of the leg

Mandika Wijeyaratne[1], A. H. Sheriffdeen[2]

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Abstract

Objectives: To establish the accuracy and identify advantages and disadvantages of colour duplex imaging compared with venography in the diagnosis of symptomatic proximal deep vein thrombosis (DVT) in our centre.

Design: Prospective study over a 15 month period.

Patients: 34 patients with 35 DVT suspected lower limbs were studied. They were first studied with colour duplex ultrasonography and the findings compared with contrast venography of the suspect limb.

Results: 17 venograms were positive for DVT and ultrasound was positive in all. There was one false positive ultrasound examination. Sensitivity and specificity for detection of proximal DVT was 100% and 94.4% respectively. Venography resulted in complications in 6 patients (phlebitis 4, skin ulceration 2). Additional diagnoses were possible with sonography (calf haematoma 1, calf neoplasm 1, deep venous reflux 2 and superficial venous reflux 5).

Conclusion: Colour coded duplex sonography is highly accurate and safe in detecting femoropopliteal thrombosis. Venography should be reserved only for duplex inconclusive situations.

Key words: Deep vein thrombosis, duplex ultrasound, venography.

Introduction

Deep vein thrombosis (DVT), especially when it involves proximal veins, has the potential to cause serious complications (1,2). Urgent treatment with anticoagulants or even thrombolytic drugs can prevent or minimize these dangers (3). These drugs with their potential for serious haemorrhagic complications cannot be started or continued for long periods without an accurate diagnosis. Clinical diagnosis of DVT is unreliable (4,5,6,7) and therefore an objective test for accurate assessment becomes necessary. Contrast venography is recognized as the gold standard examination. However, venography has many disadvantages such as exposure to radiation and contrast, being invasive and the high cost involved (8). These disadvantages have led to the development of many non-invasive diagnostic alternatives during the past decade (9). Duplex ultrasonography is posing a real challenge to venography and is the first line investigation in many centres (10). In Sri Lanka we are still relying primarily on venography to establish the diagnosis of DVT. The University Department of Surgery in Colombo is the first colour duplex vascular scanning facility in Sri Lanka. We report the results of a prospective study among patients with suspected deep vein thrombosis.

Objectives

To establish the accuracy and identify advantages and disadvantages of colour duplex imaging compared with venography in the diagnosis of proximal DVT among those with symptoms referred to our centre.

Patients

35 DVT suspect lower limbs in 34 patients referred to the Vascular Laboratory, Department of Surgery, University of Colombo, National Hospital

1. *Senior Lecturer,*
2. *Professor & Head, Department of Surgery, University of Colombo and National Hospital of Sri Lanka.*

of Sri Lanka over a period of 15 months had their colour duplex ultrasonography findings compared with those of contrast venography.

Exclusion criteria were critically ill patients in intensive care who could not be transported to the radiology department for venography, failed or inconclusive studies, known allergies, pregnancy, heart failure, renal failure (8) and lack of consent.

Equipment and assessment: Hewlett Packard Sonos 1000 colour duplex machine with a 7.5/5.5 MHz linear array transducer was used. The distal external iliac, common, deep and superficial femoral veins and the popliteal vein down to its below knee termination were imaged in longitudinal and transverse section with the patient in a supine position. The calf veins were not imaged.

The veins were identified on the basis of its consistent relationship to the easily identified main artery, which is its immediately adjacent and parallel longitudinal tubular structure with flow in the opposite direction. The vein was considered normal if the lumen showed complete colour filling, free of filling defects of varying echogenicity and was compressible with the transducer pressing on it in a transverse and longitudinal section. The phasicity of flow during deep inspiration and expiration suggested ileofemoral patency and augmentation of flow with a calf squeeze suggested distal patency.

Diagnostic criteria for deep vein thrombosis were absence of intraluminal colour and colour filling defects, intraluminal echogenic masses on grey scale, incompressibility of the vein using transducer pressure and doppler flow waveform abnormalities such as loss of phasicity with breathing and loss of augmentation with a distal squeeze (11,12). Both limbs (normal and symptomatic) were scanned in all patients.

Contrast venography was performed only in the symptomatic limbs and the results were interpreted according to the method described by Rabinov and Paulin (13). Details of those excluded from the study on the basis of the exclusion criteria and procedural complications were recorded.

Results

Table 1 gives the results of comparison of duplex ultrasonography with venography. One patient was diagnosed as having isolated calf vein thrombosis on venography. Problems associated when selecting and performing venography are depicted in Table 2. Venography was delayed until the swelling subsided in 2 instances and cannulation failed in 1. Patients were reluctant to consent for repeat venograms. Extravasated contrast induced skin necrosis and ulceration was seen in 2 and clinical phlebitis in 4. Contrast allergies were not seen during the study.

Table 1

Comparison of duplex ultrasonography with venography

	Venogram positive	Venogram negative
Duplex positive	17	1
Duplex negative	0	17

Sensitivity 100%; Specificity 94.4%; Confidence Interval 70.6-99.7% Predictive Value positive 94.4%; Predictive Value negative 100%

Table 2

Problems associated with selecting and performing venography

Failed venous cannulation	1
Patients in Intensive Care Units	3
Pregnancy	4
Phlebitis	4
Extravasation of contrast – ulcer	2
Delay due to oedema	2
Allergies	0

Discussion

The accuracy of clinical diagnosis of DVT was only 17/35 (50%) and similiar to those reported elsewhere (4,5,6,7). Screening for DVT has shown that up to 65% of proximal DVT is asymptomatic and the diagnosis would not even be considered (14). The low accuracy of clinical features makes us having to rely on other methods to establish the diagnosis prior to proceeding with treatment. The problems associated with our current gold standard, the contrast venogram, are shown in Table 2. There is under reporting of these negative aspects in the literature. The necessity for an equally accurate and safer diagnostic alternative is apparent among our patients.

Colour coded duplex sonography offers simultaneous visualization of structure by way of real time grey scale B-mode images and flow by colour coding of pulsed doppler frequency spectrum. Our results with respect to sensitivity, specificity and accuracy are satisfactory and compare well with several other studies and meta-analyses (12).

With regard to duplex criteria for diagnosis, incomplete or absent color filling and incompressibility of the vein lumen on transverse and longitudinal scanning were very useful. Other series comment only on incompressibility as the most reliable feature and ignore the value of colour (10, 11, 12). Our experience is that incompressibility is not absolute and veins that are completely occluded are also compressible to some extent. The interpretation of incompressibility may have a longer learning curve. The other problem encountered with the compressibility test is local pain and discomfort especially over swollen areas and in obese patients. Hence we were much more comfortable to base our conclusions on intraluminal colour filling.

The only false positive result was during the early phase of the study in a patient with a grossly scarred groin and a stiff swollen lower limb caused by previous surgery, which made examination difficult and should have been classified as inconclusive.

We did not look for calf vein thrombi since several studies have reported only about a 5% incidence of isolated calf vein thromboses which has a benign course and need not be treated with anticoagulants (15). The only patient with isolated calf vein thrombosis in our series did not show proximal progression and did not need anticoagulants.

With respect to the safety, colour coded duplex ultrasound is non invasive, painless and has no radiation or contrast injection hazard. Other advantages are that it can be performed at the bed side, is time sparing, easily repeated and permits diagnosis of other abnormalities that mimic deep vein thrombosis such as haematoma, neoplasms, superficial and deep venous reflux, as was seen in our series.

Patients suspected of having DVT who could not undergo venography for medical and practical reasons, had their treatment based entirely on duplex findings.

We conclude tht colour coded duplex sonography is a highly accurate, simple, safe and pain free non-invasive method for detecting proximal (femoro-popliteal) deep vein thrombosis. Duplex scanning should be the first line of investigation, and venography reserved for duplex inconclusive situations only.

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