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Original article

Clinical examination of varicose veins – a validation study

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The aim of this study was to determine the accuracy of clinical tests compared to colour duplex imaging in patients with primary varicose veins using a prospective, blinded comparison study. A total of 44 patients (70 limbs) with primary, previously untreated varicose veins presenting to the vascular laboratory of a university teaching hospital were studied. The patients underwent physical examination using the cough test, the tap test, Trendelenbergs' test, Perthes' test and hand-held Doppler (HHD) assessment prior to undergoing colour duplex scanning.

Reflux was detected on duplex scanning, at the sapheno-femoral junction in 39/70 limbs (54%), the long saphenous vein in 47/70 limbs (64%) and the sapheno-popliteal junction in 9/70 limbs (13%). The cough test had low sensitivity (0.59) and specificity (0.67). The tap test had low sensitivity (0.18) and high specificity (0.92). The Trendelenberg test had high sensitivity (0.91) but low specificity (0.15). Perthes' test had a high sensitivity (0.97) but low specificity (0.20). Hand-held Doppler assessment of reflux at the sapheno-femoral junction, in the long saphenous vein and at the sapheno-popliteal junction had high sensitivity (0.97, 0.82, and 0.80, respectively) and specificity (0.73, 0.92, and 0.90, respectively) of detecting reflux.

Clinical tests used in the examination of patients with primary varicose veins are inaccurate. Assessment using hand-held Doppler is more accurate. Courses and clinical textbooks should be revised to replace these tests with instruction in how to use hand-held Doppler in the clinical examination of patients with varicose veins.

Key words: Clinical examination – Varicose veins – Hand-held Doppler – Colour duplex

The teaching of clinical examination is an important part of the education of medical students and junior doctors. However, many aspects of physical examination are of questionable accuracy and, therefore, should be reviewed in light of an expanding curriculum.

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In a recent review of widely used basic surgical textbooks, we found that there are sections devoted to describing tests used in the examination of patients with varicose veins. Is it valid to include these clinical tests in current textbooks, as there is little information available regarding their accuracy?

As we enter the third millennium, we are still using techniques of clinical assessment developed in the last century. Over the last two decades, the availability and use of continuous wave hand-held Doppler ultrasound (HHD) in the assessment of patients with arterial and venous disease has increased. It has been used to demonstrate both patency and valvular incompetence in the venous system of the lower limb.[1,2] It has also been shown that inexperienced personnel can rapidly acquire sufficient expertise to use the instrument effectively.[3]

The aim of this study was to determine the accuracy of clinical tests and hand-held Doppler ultrasound compared to colour duplex scanning – the 'gold standard' for non-invasive assessment of sites of reflux from the deep to the superficial venous system.

Patients and Methods

This prospective study was performed in the vascular laboratory of a university teaching hospital. Informed consent was obtained from all patients enrolled in the study. Patients who were thought to have secondary varicose veins or those who had previous venous surgery were excluded. Clinical examination was performed by a house officer (JK) after a period of instruction by a consultant vascular surgeon (PJK).

Seventy limbs with primary, previously untreated varicose veins in 44 consecutive patients (35 female and 9 male, age 18–84 years) presenting to the vascular laboratory for duplex scanning were studied. The clinical severity of the venous disease was noted using the CEAP classification.[4] The following clinical tests were performed as described in standard surgical textbooks.

In the supine position, each limb was palpated to identify calf fascial defects and, if present, these were measured from the medial malleolus.[5]

The cough test

With the patient standing, a finger was placed on the thigh over the sapheno-femoral junction (SFJ). A palpable thrill or impulse on coughing was taken to indicate an incompetent SFJ.[5]

The tap test

With the patient standing, one of the examiner's hands was placed over the SFJ and the long saphenous vein (LSV) was then tapped at the level of the knee with the other hand. A palpable transmitted impulse denoted that the long saphenous vein was distended with blood. The SFJ was then tapped and the presence of an impulse was looked for at the knee. A retrograde, palpably transmitted impulse was felt to indicate incompetence of valves between the SFJ and the LSV at the level of the knee indicating reflux in the proximal LSV.[5]

The Brodie-Trendelenberg test

With the patient in the supine position, the leg under investigation was elevated to 45° to drain the varicosities. A tourniquet was applied just below the SFJ and the patient asked to stand. If the tourniquet prevented filling of the varicosities the site of reflux was deemed to be the SFJ.[5]

Perthes' test

With the patient standing, a tourniquet was applied below the knee. The patient was asked to do 10 heel raises on the spot. If the varicosities emptied, the site of reflux was determined to be above the tourniquet (SFJ, MTP or SPJ). If the veins remained distended the site of reflux was taken to be below the tourniquet (calf perforator incompetence). If the patient complained of pain, the possibility of deep venous occlusion was considered.[5]

Hand-held Doppler

Using a continuous wave, hand held Doppler (Huntleigh Technologies, UK) with an 8 MHz probe, the patient was asked to bear weight on the leg not under investigation. The femoral pulse was located in the groin and the probe moved medially to locate the SFJ. The calf was squeezed and augmentation of venous flow was noted. On calf release, the presence of reflux was noted. Reflux lasting greater than 0.5 s was deemed to be significant.[6] The probe was subsequently placed over the LSV at the level of the knee and the procedure repeated to determine the presence of reflux in the LSV. The procedure was then repeated over the sapheno-popliteal junction (SPJ) behind the knee.

Every patient underwent colour duplex scanning of the veins of the lower limb together with guided

Table 1 Sites of reflux in 70 limbs on colour duplex scanning

	No deep vein reflux	SFV reflux only	PV reflux only	SFV & PV reflux
SFJ & LSV reflux	30	–	–	2
SFJ & antero-lateral vein reflux	3	–	–	–
SFJ, LSV & antero-lateral vein reflux	1	–	–	–
SFJ, LSV, SPJ & SSV reflux	3	1	–	–
SFJ, LSV & SPJ reflux	1	–	–	–
SFJ, antero-lateral vein & SPJ reflux	1	–	–	–
MTP & LSV reflux	–	1	–	–
SPJ & SSV reflux	2	–	–	–
SSV & Giacomini vein reflux	1	–	–	–
MCP reflux	2	–	–	–
LSV reflux	6	–	–	–
Antero-lateral vein reflux only	2	–	–	–
LSV & antero-lateral vein reflux	1	–	–	–
No sites of reflux identified	13	–	–	–

MCP, mid calf perforator; MTP, mid thigh perforator; other abbreviations explained in text.

Table 2 The sensitivity, specificity, positive and negative predictive values of clinical tests compared to colour duplex scanning

	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Cough test	0.59	0.67	0.67	0.59
Tap test	0.18	0.92	0.80	0.39
Trendelenberg test	0.91	0.15	0.58	0.12
Perthes' test*	0.97	0.20	0.83	0.63
HHD SFJ	0.97	0.73	0.80	0.96
HHD LSV	0.82	0.92	0.84	0.74
HHD SPJ	0.80	0.90	0.57	0.97

*Of the 70 limbs, 21 test results were equivocal).

pulsed wave spectral Doppler. Duplex imaging was carried out immediately after clinical assessment as changes in the pattern of reflux can be expected to occur if there is a prolonged period between assessments.[7] The examination was performed by a dedicated vascular technologist (SR), who was unaware of the results of clinical and HHD assessment.

Duplex scanning

Duplex scanning was performed using a Diagnostic Ultrasound Systems 3535 machine (B&K Medical, Denmark), with a 5 MHz curvi-linear probe. Deep venous patency was assessed with the patient semi-recumbent, with the hip externally rotated and the knee slightly flexed. The vein compression technique was used to test for femoral and popliteal venous patency, and colour Doppler for tibial vein pair patency. The calf was squeezed and released by hand while an area of interest was being insonated using colour and then spectral Doppler. Reversed flow of over one second duration was classed as abnormal, but only regarded as significant if it persisted longer than the initial augmentation of venous flow from the calf squeeze. The presence of reflux in the femoral and popliteal veins, the long and short saphenous veins and at the sapheno-femoral and sapheno-popliteal junctions, in incompetent thigh perforators and calf perforators was routinely sought.

The sensitivity, specificity, positive predictive value and negative predictive values of each clinical test and hand held Doppler assessment were calculated compared to the 'gold standard', colour duplex scanning.[8,9]

Results

The clinical severity of the venous disease in each limb was assessed using the CEAP classification. Telangectasia (class 1) were the clinical presentation in 2 limbs, uncomplicated varicose veins (class 2) in 67 limbs and oedema complicating varicose veins (class 3) in 1 limb.

The sites of reflux identified on colour duplex scanning are demonstrated in Table 1. Associated deep venous reflux in the superficial femoral vein (SFV) or the popliteal vein (PV) was identified in four limbs (6%).

Calf perforator incompetence was identified in only two limbs on colour duplex scanning. Calf fascial defects were palpated in 11/70 (15.7%) limbs, ranging from 16–31 cm from the medial malleolus. Only one of

these 11 limbs (9%) was positive for calf perforator reflux on colour duplex scanning.

The sensitivity of a test is the proportion of true-positives that is correctly identified by the test. The specificity is the proportion of true-negatives that is correctly identified by the test.[8] The positive predictive value is the proportion of patients with positive test results who are correctly diagnosed. The negative predictive value is the proportion of patients with negative test results who are correctly diagnosed.[9] The sensitivity, specificity, positive predictive and negative predictive values are outlined in Table 2.

Discussion

The art of clinical examination has developed over many centuries but has reached its peak in the 20th century. The explosion in knowledge in the latter part of the century has lead to a deeper understanding of the pathophysiological processes of many conditions and technological advances have lead to the development of cheaper instruments, which may aid clinical diagnosis. This has implications for what medical students learn, as the volume of information is increasing and there appears to be little effort to assess the quality of some of the established information. We were surprised to discover that textbooks aimed at medical students and senior house officers still advocated some or all of clinical tests alluded to in our paper. More surprising, was the lack of information on hand-held Doppler assessment of patients with varicose veins. This study attempts to determine the quality of information gained in the examination of patients with varicose veins using well established clinical tests.

There have been a number of studies published suggesting that clinical examination of varicose veins is not accurate.[10,11] The actual clinical tests used were not described in one study and accuracy of individual tests was not described in either. One other study has been performed prior to the advent of colour duplex scanning and the 'gold standard' used in this study was the presence of reflux at operation.[12] Selection bias was a major limitation of this study, as a decision had been taken to operate on all patients prior to inclusion in the study.

The findings of a review of studies on the location of calf perforator incompetence, which indicated that palpation of calf fascial defects is inaccurate, has been confirmed by the present study.[5]

In this study, we demonstrate that the commonly used clinical tests are quite inaccurate in assessing the sites of reflux in patients with varicose veins. They are not accurate in localising sites of reflux from the deep to the superficial venous systems and, therefore, it would not be feasible to plan surgical procedures on the basis of the findings on clinical examination. It is not possible to compare the accuracy of clinical examination of varicose veins in this study with previously published studies, as there is no comparable data.[10–12] The reason that tourniquet tests are unhelpful is probably because the pressure required to prevent reflux in the superficial veins may vary from 40–300 mmHg.[13]

Hand-held Doppler examination is a much more accurate method of assessing patients with primary varicose veins. The sensitivities, specificities, positive and negative predictive values of hand-held Doppler assessment in this study are similar to those published elsewhere in the literature.[10,14–17] The low positive predictive value of detecting reflux at the SPJ is probably due to anatomical variation in the site of the SPJ and also by reflux in the vein of Giacomini, which connects the long to the short saphenous system. It may be possible to plan surgical procedures using only this method of examination in selected cases.[14]

Conclusions

We conclude that clinical tests used in the examination of patients with varicose veins are inaccurate. Textbooks and courses should be revised to replace these tests with instruction in how to use hand-held Doppler in the clinical examination of patients with varicose veins.

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