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## Preoperative Assessment of Primary Varicose Veins: a Duplex Study of Venous Incompetence

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**Objectives:** we investigated the importance of preoperative duplex scanning in primary uncomplicated varicose vein surgery by evaluating the incidence of superficial venous incompetence and significant anatomical variations that may be difficult to detect clinically and therefore might be expected to contribute to recurrence.

**Design:** a retrospective study of a prospectively collected database.

**Materials:** over 15 consecutive months, patients attending the non-invasive vascular laboratory for duplex scanning of their primary uncomplicated varicose veins were assessed.

**Methods:** vascular laboratory case notes were assessed and incidence of superficial venous incompetence and any significant anatomical variations that would have been difficult to detect clinically  $\pm$  HHD were documented. Any correlation with clinical findings was also evaluated.

**Results:** a total of 223 limbs (176 patients) were assessed. Sixty-seven limbs (30%) in fact had a competent sapheno-femoral junction. Sixty-one limbs (27%) had pure sapheno-femoral reflux and nil else. Fifty-three limbs (24%) had significant anatomical variations. Forty-two limbs (19%) had short saphenous vein incompetence, of which 67% were clinically unsuspected.

**Conclusions:** preoperative duplex scanning is indicated in all patients with uncomplicated primary varicose veins if appropriate venous surgery is contemplated. There are obvious resource and recurrence rate implications. Further evaluation in the form of randomised trials are required.

**Key Words:** Duplex scanning; Primary varicose veins; Preoperative; Venous incompetence.

### Introduction

Recurrence rates as high as 65% have been reported following surgery for primary uncomplicated varicose veins.<sup>1</sup> In most cases the recurrences have been linked to inappropriate or inadequate surgery in the first instance.<sup>2,3</sup> Traditionally, preoperative assessment of primary varicose veins has included a clinical examination utilising the Trendelenburg test. However, this has clearly been demonstrated to be unreliable, with clinical uncertainty rates of over 40% depending upon the superficial vein assessed.<sup>4</sup> Recently, clinical accuracy has improved with the adjunctive use of the continuous wave form hand-held Doppler (HHD). However, this modality remains inaccurate due to the inability to confidently identify the vessel being insonated. The use of the "gold standard", colour flow duplex scanning, is currently reserved for specialist

vascular units or where complex disease such as recurrence is suspected. Currently 20% of new referrals to venous clinics are for recurrent varicose veins; therefore a reduction in recurrence rates would represent a major saving for the National Health Service.<sup>5</sup> This study evaluates the importance of preoperative Duplex scanning in all patients with primary uncomplicated varicose veins by assessing the radiological incidence of sapheno-femoral (SFJ) and sapheno-popliteal (SPJ) incompetence. In addition, any significant anatomical variations that would have been impossible or difficult to detect clinically or with HHD and which might contribute to recurrences were also investigated.

### Materials and Methods

The study performed was retrospective. From an existing prospective database, all patients attending the non-invasive vascular laboratory between June 1998

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and September 1999 for duplex scanning of their primary uncomplicated varicose veins were identified. All subjects had been assessed in the outpatient department using clinical examination with or without the HHD by consultant staff or specialist registrar level trainees and subsequently had colour flow scanning prior to proposed venous surgery. Although each vascular laboratory request form clearly stated the presence of primary varicose veins and their location along with some details of the major refluxing systems, other clinical conditions were not always recorded in detail. The clinical and CEAP data was incomplete and therefore not included so as to avoid generating misleading information. The incidence of SFJ and SPJ junction incompetence detected by duplex scanning was investigated. Any anatomical anomalies detected on scanning were also investigated along with sites and sizes of incompetent perforating veins.

All duplex scans were performed by either of two trained vascular technologists. A 10 MHz and 5 MHz imaging probe for the superficial and deep venous systems respectively were utilised. The probes were integrated with a 4 MHz pulsed Doppler (Diasonics SVT Masters, U.S.A.). The investigation was performed with the patient on a tilting table in supine position at 20–25° to the horizontal. Reflux was defined as visible and audible retrograde flow lasting 0.5 s or more on squeezing the limb distally. The sites and maximum diameters of all incompetent perforators equal to and greater than 3 mm diameter were documented.

There is a process of quality control in our unit which ensures the work of the technologists is regularly validated by vascular radiologists.

## Results

During the 15 consecutive months of the study 176 patients (113 female, 63 male), attended the vascular laboratory for colour flow duplex scanning of their primary uncomplicated varicose veins. A total of 223 limbs were included in the study. The mean age of patients scanned was 57 years; range 15–86 years.

In 67 (30%) limbs the SFJ was competent (Table 1). In 19 (29%) of these the varicose veins could be explained by incompetent perforators, equally distributed at thigh level and at calf level. In 12 of 67 limbs (18%) there was reflux in the short saphenous vein (SSV) and anatomical variations were seen in eight (12%) of the 67 limbs. In 14 (21%) of 67 limbs there was, in fact, no abnormality seen on duplex scanning. In the remaining 14 limbs in this group there

**Table 1. Characteristics of 67 limbs found to have competent sapheno-femoral junctions on duplex scanning.**

Type of abnormality	No of limbs	% of 67
Perforators only	19 (9-thigh, 10-calf)	29%
SSV incompetence	12	18%
Anatomical variations	8	12%
SSV incompetence and perforator and anatomical variation	5	7.5%
Anatomical variation and perforator	4	6%
Anatomical variation and SSV reflux	4	6%
Perforator and SSV reflux	1	1.5%
No abnormality on scanning	14	21%

was a combination of anatomical variations, SSV reflux and incompetent perforators that could have accounted for the varicose veins.

Of the 223 limbs in the study, 53 (24%) limbs were found to have significant anatomical variations that would have been difficult or impossible to detect using clinical methods with or without use of HHD. The majority, 31 limbs (59%), were accounted for by splitting of the long saphenous vein (LSV) into two or more branches at thigh level. At least one of these branches demonstrated reflux on duplex scanning. In 10 of the 53 limbs (19%) the origin of the LSV was found to be bifid, while in four limbs (7.5%) the origin was varicose. In five limbs (9%) there was a communicating branch from the LSV to the SSV making the latter incompetent. In the remaining three limbs there was a combination of anatomical variations (Table 2).

Forty-two of the 223 limbs (19%) included in the study had sapheno-popliteal junction incompetence. Of these, reflux was unexpected in 28 limbs (67%) as judged by whether it was mentioned or specifically excluded in the radiology request form. In two limbs reflux at the SPJ was suspected clinically but not confirmed on scanning. Of the 223 limbs included in the study, 61 (27%) had pure SFJ incompetence with no other abnormality detected on scanning.

**Table 2. Characteristics of 53 limbs found to have significant anatomical variations on Duplex scanning.**

Type of anatomical variation	No of limbs	% of 53 limbs
LSV splits at thigh level	31	59%
Bifid origin of LSV	10	19%
Varicose origin of LSV	4	7%
LSV-SSV communicating branch	5	9%
Varicose and bifid at origin	1	2%
Bifid origin and communicating		
LSV-SSV branch	1	2%
Anomalous varicose gluteal vein branch	1	2%

## Discussion

The preoperative assessment of primary uncomplicated varicose veins remains contentious. Previous studies have demonstrated that if clinical examination alone is used to assess primary varicose veins, inappropriate surgery will be performed in 20–41% of limbs depending upon the junction examined.<sup>2,6</sup> If, however, the HHD is used as an adjunct to clinical examination, inappropriate surgery will still be performed in 13% of cases.<sup>2</sup> In a series of 100 consecutive patients Darke demonstrated inaccuracies with the HHD with inadequate/inappropriate surgery rates of 14%.<sup>7</sup> These figures suggest that clinical and HHD examination do not provide a completely accurate assessment of superficial vein incompetence prior to surgery.

In our vascular unit we have adopted a policy of performing duplex scanning on all patients so as to enable accurate and targeted surgery. Our study has demonstrated competence in the sapheno-femoral junction in approximately 30% cases. This degree of competence of the sapheno-femoral junction on scanning has also been demonstrated by Singh *et al.* in a prospective study including 71 limbs.<sup>2</sup> The exact correlation of SFJ incompetence to clinical findings at presentation in the outpatient clinic, however, is unclear due to the absence of this information on the vascular laboratory request form. In the case notes examined, however, 21 (31%) of request forms suggested that the SFJ was in fact incompetent. This 69% sensitivity with clinical examination  $\pm$  HHD in our retrospective study is lower than Singh *et al.*'s prospective study which showed that although HHD improves diagnostic accuracy, it still fails in approximately one in every 10 limbs with primary varicose veins.<sup>2</sup>

Our study has also demonstrated incompetence in the SPJ in approximately 20% cases on duplex scanning. This 20% incidence of sapheno-popliteal incompetence in primary varicose veins has been previously documented.<sup>8</sup> Our vascular laboratory request forms encourage the reporting of clinically evident reflux of the long or short saphenous vein to aid the vascular technologist. However, on reviewing the case notes of this subset of patients it was evident that in over 66%, reflux of the short saphenous vein was either specifically excluded clinically or no mention was made of its presence. This large discrepancy between clinical and duplex findings (66%) at the SPJ reflects the previously described difficulty in assessment of the popliteal junction using clinical methods<sup>7</sup> and encourages the use of duplex scanning where available.

We have demonstrated that anatomical variations are present in almost 25% of all cases of uncomplicated varicose veins. The relevance of these anatomical variants detected to the practice of venous surgery is unclear. Although some of the anomalies, such as communicating branches between the long saphenous vein and short saphenous vein, would have been difficult or impossible to detect using clinical examination  $\pm$  HHD, others such as a bifid and varicose SFJ would have been apparent during surgery and dealt with appropriately. The majority (67%), however, consisting of splitting of the LSV into two or more branches, one or more of which was incompetent, would be missed at surgery without prior documentation with duplex scanning. If such refluxing veins are not recognised and surgically removed, they might be expected to contribute to recurrences.

We have shown that in 6% of limbs scanned prior to surgery there will be no abnormality seen. The clinically detected varicose veins in this subset of patients are likely to represent simple localised varicosities of reticular veins with no stem vein involvement, which will require less extensive surgery in the form of simple avulsions only. This would obviate the need for longer and more complex procedures such as dissection of junctions and stripping that a surgeon might be tempted to perform without the benefit of duplex scanning.

The cost implications of performing duplex scanning are not insignificant. Our non-invasive vascular unit currently employs a chief technologist assisted by two junior technologists. The laboratory assesses up to 3000 limbs per annum with running costs of around £120 000 per year. From lease-cost figures and salaries we calculate that it costs £40 per scan per limb in our non-invasive vascular laboratory. In the overall context of varicose vein surgery and potential recurrence rates this figure is relatively insignificant.

It is an essential prerequisite of any surgical procedure to have an accurate diagnosis prior to intervention. Although as yet there are no established data based on prospective trials to indicate that preoperative scanning reduces recurrence rates in varicose vein surgery, our study suggests that preoperative duplex assessment allows targeted ablative surgery. We believe that this is important if recurrence rates are to be reduced to the minimum possible. As the resource-limited National Health Service currently sees over 50 000 patients per year for varicose vein surgery this would represent a major potential saving, especially as 20% of venous surgery is performed for recurrences.

Finally, it is recognised that undertaking preoperative duplex scanning on all patients with primary

varicose veins has major manpower implications given the current limited numbers of vascular technologists. This must not, however, deter us from attempting to provide the highest standard of pre-operative evaluation of patients with primary venous disease.

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