


<b>Vascular Studies Unit</b>  <b>Protocol: Lower Limb Venous Ultrasound Scan</b>  <b>RRCV</b>	University Hospitals of Leicester  NHS Trust  <b>VSU Reference Number: 014</b>
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<b>Reviewed by:</b>	<b>VSU Clinical Scientist Working Group, Oct 2020</b>
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Abbreviations	
DVT	Deep Vein Thrombosis
CFV	Common Femoral Vein
FV	Femoral Vein
PFV	Profunda Femoral Vein
ALTV	antero-lateral thigh vein
LSV	Long Saphenous Vein
SSV	Short Saphenous Vein
COPD	chronic obstructive pulmonary disease

Changes Made	By	Date
Planned Review, Updated indications/contraindications list, aligned with SVT protocol, added venous stents	All / JW	Sept 2019
Layout changes and planned review	PK	March 2021

## Protocol: Lower Limb Venous Ultrasound Scan

### Purpose:

Patients are often referred for vein scanning with symptomatic varicose veins, including painful legs, venous eczema or skin changes and ulceration. The scan aims to identify patency and competency of the deep, superficial, and connecting venous systems. It is also necessary to identify the supply to any superficial refluxing vein, be this native origin, perforator(s) or neo-vascularisation. This is particularly useful when previous vein surgery has been carried out and native junctions are no longer believed to be intact. To provide a report to allow surgeons to determine appropriate treatment pathways.

**Incorporating the SVT Guidelines:** Lower Limb Venous Duplex Ultrasound Examination for the Assessment of Venous Insufficiency/Incompetence

### Common Indications:

Common indications for the performance of lower limb venous insufficiency evaluation include, but are not limited to:

- Skin changes, venous eczema, hyperpigmentation
- Venous ulcers
- Recurrent swelling of the lower calf and ankles
- Pain or feelings of heaviness in the lower extremity
- Visible varicose veins
- Venous claudication
- Pain and oedema of the lower extremities

### Contraindications & Limitations:

- Patients with high body mass index
- The presence of ulcers, wounds, bandaging or casts and for patients who have had recent surgery, ultrasound visualization may be limited due to oedema, haematoma, surgical staples, dressings etc
- Patients who are unable to lie with their limbs flat or still due to extreme pain or pre-existing co-morbidities e.g. chronic obstructive pulmonary disease (COPD) and arthritis – although these patients may be able to tolerate being examined seated with the limb dependent or with the head of the bed raised where practical.
- Patients who are unable to cooperate due to reduced cognitive functions e.g. Alzheimer's or dementia and through involuntary movements
- Examinations undertaken portably at the patient's bedside maybe limited due to equipment and room dimensions.
- The presence of catheters or vascular access lines which limit visualization of the vessels.
- Patient discomfort, particularly calf tenderness.

### Communication with patients:

The patient must be capable of sitting on the edge of the couch with legs dependent and their feet placed on a footstool, or using a couch with lower leg tilting of at least 30 degrees, or standing if required. This is to be able to assess the competency of the valves against gravity. It is explained to the patient that the test is carried out to look at their leg veins which may involve calf augmentation and leg compression with the transducer. In most cases, the test will be completely painless but may cause some discomfort if there is extensive ulceration or tenderness of the leg. It may occasionally be necessary to explain the principles of a valsalva manoeuvre.

**N.B** It is not unusual for patients to feel faint during this assessment, so it is advisable to monitor their well-being regularly (onset of yawning can be a useful sign of imminent feelings of faintness). The Clinical Vascular Scientist must keep alert to the possibility of a vasovagal response and react accordingly (such as lying patient flat on the couch with legs raised).

### Obtain a relevant history:

- Presence of risk factors e.g. previous DVT and/or superficial venous thrombosis, lower extremity trauma, history of venous ulcers, family history of varicose veins
- history of previous treatment to varicose veins
- Nature of patients symptoms
- current medications or therapies regarding the lower limb venous complaint ie compression hosiery
- Complete a limited physical exam, which includes observation and localization of the presence of any signs or symptoms of peripheral venous disease: swelling, pain, tenderness, discoloration, varicosities and ulceration
- Verify that the requested procedure correlates with the patient's clinical presentation

### Test procedure:

Select an appropriate frequency transducer, changing where required, considering vessel depth and body habitus. For lower limb vein assessments, evaluation of the following veins should be included, as appropriate:

- CFV (Patency check)
- PFV origin (Patency check)
- FV
- Popliteal Vein
- Long Saphenous Vein
- Short Saphenous Vein

**The following techniques should be applied to all venous segments:**

B-mode should be utilised to assess vein patency by observation of the compressibility of the vein, this should be done in a transverse scan. Pulsed and colour Doppler should be utilised to assess flow characteristics within the veins, this will include assessment of phasicity, spontaneity and direction of flow. Flow characteristics will generally be assessed in a longitudinal scan plane. Manual or automated distal augmentation should be used to enhance the flow and to assess for reflux.

**Deep Veins**

For FV & Pop Vein, in longitudinal section, using both spectral and colour Doppler, quantify the extent of reverse flow demonstrated after employing the appropriate augmentation technique. If reflux is noted in the AK popliteal vein but does not continue into the below knee segment, it is usual to identify any other implicated vessels. This may be the SSV origin, common origin with the gastrocnemius vein, a bifid portion of the BK popliteal vein, the gastrocnemius vein or a perforator. Greater than 0.5 sec is defined as reflux. If acute, chronic thrombus is found incidentally in the deep vein systems, please refer to the DVT protocol.

**Long saphenous Vein**

The LSV can appear in a range of positions between the antero-medial and postero-medial thigh and can be confused with major branches of the LSV such as the antero-lateral thigh vein (ALTV). If the vessel demonstrates reflux which cannot be traced back to a communication with the deep venous system in the groin (particularly post high-tie), it is necessary to look for branches or perforators which may be supplying the LSV. In longitudinal section, check the vein for reflux at its origin and at points along its length, paying particular attention to sites of branching or where sudden diameter changes are seen. If perforators are seen they should be checked for reflux (defined as flow from the deep to the superficial veins following calf release), and where reflux is found a diameter measurement should be taken.

Continuous forward flow in the long saphenous vein needs to be noted, as this finding frequently accompanies proximal deep venous occlusion, however the phenomena is also apparent in cases of hyperaemia.

**Short Saphenous Vein**

The same technique may be applied to scanning the short saphenous vein (SSV) which is evident in the posterior calf and lies in the same position as the seam of a stocking. A refluxing SSV may be supplied from the sapheno-popliteal junction (SPJ), Giacomini vein, perforator, LSV or other branch(es). If, at the end of this process, the supply to an area of varicosities has not been obviously identified as arising in either the long or short

saphenous distribution, the area of varicosities may be scanned to look for supplying branches or perforators, including any other superficial veins evident on the scan such as the ALTIV and thigh extension of the SSV (Giacomini vein).

**Severity of reflux can be defined as follows:**

Grading of Venous Reflux*	
Grade	Reflux Duration
Normal Valve Function	Reflux duration of <0.5 s, rapid closure of venous valves
Moderate reflux	Reflux duration of 0.5-1 s, mild to moderate retrograde flow
Significant reflux	Reflux duration of >1 s, large volume of retrograde flow
*Peripheral Vascular Ultrasound, How, Why, When, Thrush & Hartshorne	

To note, with gross venous stasis it may be difficult to augment flow and very little reflux will be demonstrated following distal release.

**Details to be recorded/measured for any incompetent superficial vein:**

- Vein calibre (including additional varices measurement), including calibre at a potential access point for endovenous treatments
- Depth from skin surface
- Presence of fascia
- Description of tortuosity

**Additional information**

- Please note on the report if the vein walls appear to be thickened/scarred/webbing.
- In the presence of finding Superficial thrombophlebitis, measure and report length/extent, proximity to a junction, occlusive or semi-occlusive, and whether this appears acute or chronic.
- Highlight if there is only a short segment (in the region of 12cm) of non-tortuous vein demonstrating reflux, as this may influence decisions for treatment options.

## Vein Mapping & Marking

Select an appropriate frequency transducer, changing where required, considering vessel depth and body habitus.

### Vein Mapping and Marking for Bypass Surgery:

The ipsilateral long saphenous vein (LSV) is commonly used in lower limb arterial bypass operations to provide an autologous conduit. A duplex scan is performed to determine the suitability of the LSV for bypass. In the absence of a suitable ipsilateral LSV, or if an insufficient length of vein is identifiable, further vein can be sought from any of the remaining limbs. Once identified, the position of any suitable vein can be marked.

### Vein Marking for Varicose Vein Surgery:

Patients undergoing ligation +/- stripping of lower limb superficial veins may require a junction or perforator to be marked (for example, especially due to the variability of the anatomy in the popliteal fossa). This facilitates easy identification of target areas at operation.

It is explained that pen markings will be made on the skin to show the position of the vein(s) as an aid to the surgeon at operation.

Measure the LSV calibre throughout its length, and ensure patency, and note areas of wall thickening or scarring. Minor varicosities and changes in diameter do not preclude suitability but significantly varicosed portions of vein should be reported. It is advisable to check patency of the CFV, FV and popliteal veins. In the arm both the cephalic and basilic veins can be assessed.

Once identified (mapped), you may be required to 'mark' suitable vein on the skin surface by using a permanent black marker pen. Prior to varicose vein surgery: junctions, origins or perforators may need to be marked as requested. Previous duplex reports provide a useful guide to the position of the relevant junction/perforator but it is appropriate to **confirm reflux at the site before marking**. Once satisfied that the supply has been identified the origin, junction or perforator should be marked with a 'x or +' using permanent black marker pen.

## Vein Stents

Vein stenting is sometimes performed in UHL to recanalise the deep venous system, typically the iliac system, following occlusive DVT. Select an appropriate frequency transducer, changing where required, considering vessel depth and body habitus.

Obtain a relevant history, including any new symptoms of leg swelling, and check the patient remains taking their anticoagulation medication.

This focused scan will determine and report the following:

- Measure stent caliber (proximal & distal, including any caliber changes, pinching or kinking)
- Native vein and stent patency (identify any areas of thrombus)
- Flow waveform comparisons of stented vein versus contralateral vein (using options such as Valsalva, augmentation, breath hold technique)

A suitable re-scan surveillance interval will be determined based on the findings and the standard surveillance pathway (surveillance re-starts after any re-intervention):

- Discharge scan
- 2 week post-op
- 6 week post-op
- 12 weeks post-op
- 6 months post op
- 12 months post-op
- Yearly thereafter



## Reporting of results:

The report is a recording and interpretation of observations made during the venous duplex ultrasound examination; it should be written by the person undertaking the examination and viewed as an integral part of the whole examination. The report should include correct patient demographics; date of examination; examination type and the name and status of the person reporting the examination.

### For Venous Reflux Assessments, the report should include:

- The presence/absence of phasic flow in the proximal veins
- Which veins have been assessed, the competency of the veins, the extent of incompetent segments, the presence/absence of any thrombus,
- Any anatomical variations due to previous procedures (i.e. absence of LSV due to previous intervention)
- Where thrombus is identified, the location, length/extent, degree of patency should be documented
- Any limitations e.g. if areas in the calf are not visualized due to ulceration

The report consists of a schematic diagram (example report Appendix 1), and this should include:

- the long saphenous and short saphenous veins and their origins
- Any varicosities, branches and perforators
- flow direction demonstrated by the use of arrows (black competent, red reflux)
- For refluxing superficial veins, add all the measurement parameters (as above)

### For Vein mapping or marking reports:

The mapped veins are drawn onto a vein diagram report with relevant caliber and anatomy annotated. For arm vein mapping this can be annotated on an arm diagram or written onto the lower limb vein report.

### For Vein Stent reports:

Record vein stent calibres and annotate stent locations on a diagram report. Record patency status and phasisty information on each vein segment annotated on the diagram. Make a note of current symptoms and anticoagulation medication. Record the next surveillance appointment date scheduled.

## Red flags



The following should be flagged to the on-call vascular team to review the patient before the patient is allowed to leave VSU:

- Acute thrombophlebitis or DVT
- Incidental findings such as acute arterial occlusion, popliteal aneurysm >3.0 cm diameter
- Thrombus of 50% or greater in a vein stent, or stent occlusion

**N.B.** In the single visit clinic setting limited investigations may be carried out as per instruction and this shall be acknowledged in the report.

### Key references:

Thrush. A. and Hartshorne. T. (2009). Peripheral Vascular Ultrasound: How, Why and When. London, Churchill Livingstone.

UHL Policy for Investigation & management of DVT: See InSite for most up to date policy

Coleridge-Smith, P, Labropoulos, N, Partsch H, Myers K, Nicolaides A, Cavezzi A. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs –UIP Consensus Document. Part 1 Basic principles.

Eur J Vasc Endovasc Surg 2006; 31:83-92

Idu. M. *et al.* (1999) 'Factors influencing the development of vein graft stenosis and their significance for clinical management'. European Journal of Vascular and Endovascular Surgery. 17: 15-21.

Society for Vascular Technology GB & I, Vascular Technology Professional Performance Guidelines Lower Limb Venous Duplex Ultrasound Examination for the Assessment of Deep Vein Thrombosis (DVT), 2019

Society for Vascular Technology GB & I, Vascular Technology Professional Performance Guidelines Venous Lower Limb Reflux Duplex Ultrasound Examination, 2019

**Example Report:**

**VASCULAR STUDIES UNIT**

University Hospitals of Leicester **NHS**

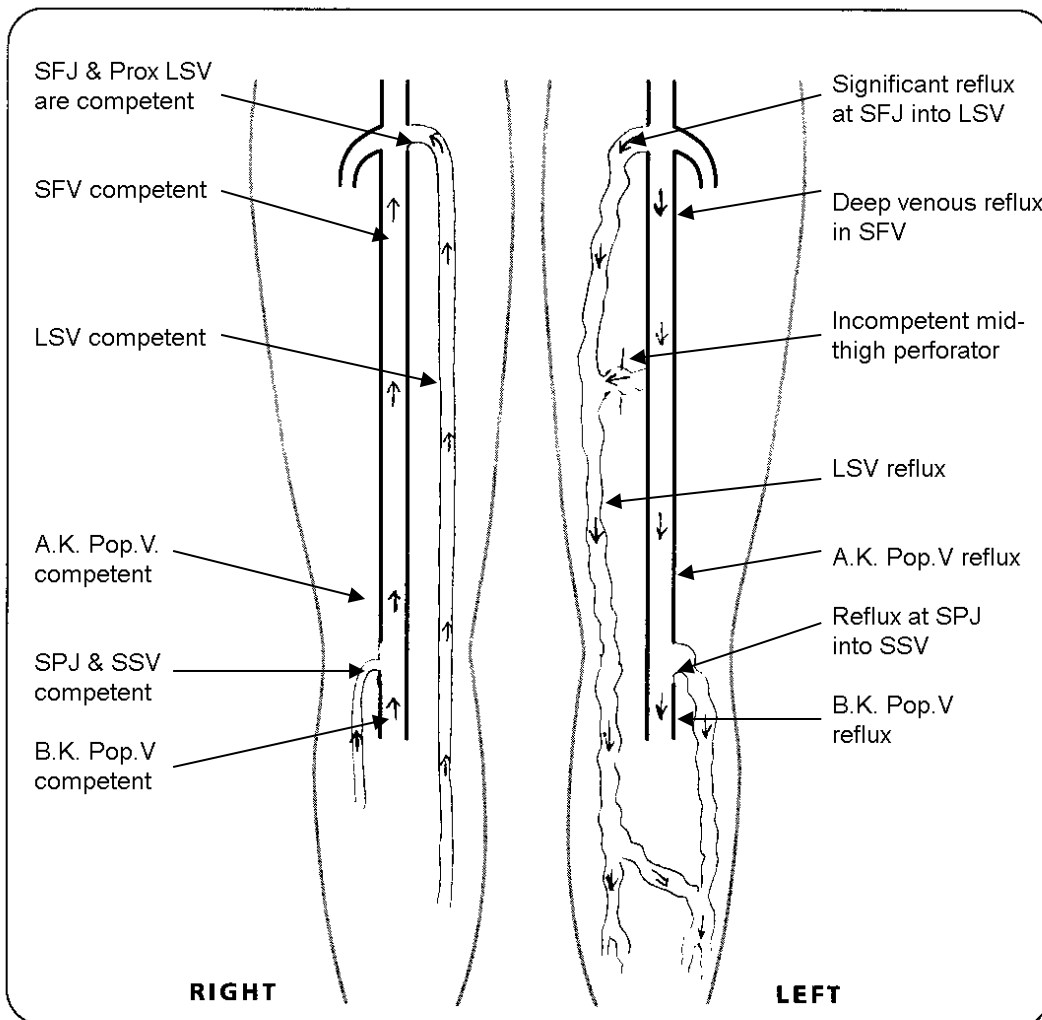
NHS Trust

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**LOWER LIMB VENOUS DUPLEX SCAN REPORT**

Surname: \_\_\_\_\_  
Forename: \_\_\_\_\_  
DOB: \_\_\_\_\_  
Unit Number: \_\_\_\_\_  
(or use patient label)

Consultant: \_\_\_\_\_  
Clinical History: \_\_\_\_\_  
Comments: \_\_\_\_\_  
Dept: \_\_\_\_\_  
Hospital: \_\_\_\_\_



SIGNED: \_\_\_\_\_ CLINICAL VASCULAR SCIENTIST

PRINT NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

Image Quality:

GOOD ☐ ☐ ☐ POOR

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