CSVS

THE COLLEGE AND SOCIETY
FOR CLINICAL VASCULAR SCIENCE
Great Britain and Ireland

Vascular Science Guidelines

# Lower Limb Venous Duplex Ultrasound Examination

## Scan Protocol

**Version 2**

**April 2026**

**PS-PG004**

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## Purpose

This document was prepared by the Professional Standards Committee (PSC) of the College and Society for Clinical Vascular Science (CSVS) to support the practise and delivery of high quality standardised Clinical Vascular Science. This document may be used in its entirety (or referenced in part with suitable additions made by local policy implementers) by all parties involved with clinical vascular science. Suggestions for improving this document are welcome and should be sent to the Chair of the PSC (see csvs.org.uk for current PSC Chair details).

## Introduction

This document will focus on the assessment of the deep and superficial venous lower limb systems for evidence of valvular incompetence and to establish the source of any reflux identified in the superficial lower limb veins. In addition, this document contains guidance for vein mapping, endovenous treatment and venous stent assessment.
For assessment for deep vein thrombosis (DVT) refer to the separate Upper and Lower Limb DVT Assessment Scan protocol[24]

# Lower Limb Venous Duplex Ultrasound Examination

## Common Indications and limitations

Common indications for the performance of a venous Duplex Ultrasound examination include but are not limited to[4]:

- Skin changes, venous eczema, hyperpigmentation and active or healed venous ulcers
- Swelling
- Pain
- Visible varicose veins
- Venous claudication
- Superficial vein thrombosis
- Acute bleeding varicose vein
- Preoperative vein mapping
- Venous stent planning and surveillance

Common limitations include but are not limited to:

- Obesity
- Ulceration/weeping wounds/extensive dressings
- Limited mobility

## Patient pathway

Within the varicose vein pathway, the assessment of venous reflux is the major diagnostic test. Further guidance is given by the Vascular Society Great Britain and Ireland publication Provision of Services for Patients with Vascular Disease 2021 [2]. Scriven et al [3] and the National Institute for Health and Care Excellence (NICE) [4].
Venous anatomy can be variable, and it is important to have a full understanding of possible variants, the recently updated venous nomenclature as well as knowledge of ultrasound identification and venous physiology [5,6,7,8,9].

## Patient referral

NICE and the Vascular Surgical Society recommends that anyone with symptomatic varicose veins should have duplex ultrasound assessment however some interventions are not routinely commissioned and/or funded in all areas by NHS England and NHS Improvement (NHSEI) and you should refer to your regional Integrated Care Board (ICB) for funding criteria and follow local protocol [2,4].

## Clinical Indications

For venous reflux scans clinical indications for this type of scanning include simple or complex primary varicose veins, secondary (recurrent) varicose veins, leg ulcers, skin changes, superficial thrombus and chronic leg swelling.
There is also evidence that duplex imaging should be a routine part of the investigation of every patient with varicose veins, particularly if they are to undergo interventions [4,5]. It is necessary as part of the selection process for surgery, foam sclerotherapy, laser and radiofrequency ablation. A duplex ultrasound investigation is also indicated where there is suspicion of reflux in the deep veins or where there is a history of deep vein thrombosis (DVT).

## Patient preparation

Access will be required to the patient's full limb. Compression stockings and where appropriate, other dressings should be removed to enable access to the areas of the limb which require scanning. These tests involve using the probe to apply pressure on the limb to compress the vein and also squeezing the limb below the level of the problem to check for venous reflux/patency. Careful explanation of this will aid compliance as these processes can sometimes be uncomfortable for the patient.
During lower limb scanning the patient needs to be positioned such that enough hydrostatic pressure is generated to get good venous filling in the calf. The position should be as similar to standing as possible [5,10,11,12,13,14,] in order to reproduce physiological conditions. Ideally the patient should be standing with appropriate support (provision of a braked couch on its highest setting to lean against or low stool with arm support or tilt table is helpful) or, where this is not possible, sitting on the edge of the couch with the legs as dependent as possible. Horizontal limb positions are not appropriate for detection of reflux [5]. Consideration should be given to the reliability of the results where patients are not able to tolerate optimal positioning.
Further information on appropriate equipment is available in the CSVS Vascular Ultrasound Service Specifications Guideline[1]
Due to the intimate nature of the examination, it may be considered necessary to offer a chaperone [15,16]. It is not unusual for patients to feel faint during lower limb assessments, so it is advisable to monitor their well-being regularly (onset of yawning and restlessness can be a useful sign of imminent feelings of faintness). A chaperone can be useful with these aspects of patient care whilst the Vascular Scientist concentrates on the ultrasound assessment.

## Explanation of Examination & Patient History

The examination should be fully explained to the patient and consent obtained. A full understanding of what is required will aid patient cooperation. A relevant medical history of venous insufficiency scan includes:

- Previous DVT or superficial thrombus
- Results of other relevant diagnostics
- Visual identification of any areas of ulceration, will aid decisions regarding cuff placement
- Previous venous interventions

## Examination

The examination may be unilateral or bilateral dependent upon clinical symptoms, referral and departmental policy.
Knowledge of venous anatomy, the variants and ultrasound appearances are essential [5] as is knowledge of previous vein treatment for the particular patient. Clinical observation of the superficial veins in the lower limb in the standing patient, in a well-lit room, prior to starting the scan is helpful in determining the scope of the scan.
If considering compression therapy for a leg ulcer an ankle brachial pressure index (ABPI) assessment should be carried out. All patients with an adequate arterial supply (ABPI>0.8) should be offered effective compression therapy with reduced compression possible (ABPI 0.8-0.5) under clinical supervision [17,18].

### Venous insufficiency

B-Mode is utilised to assess vein patency by observation of the compressibility of the vein, this is performed in a transverse scan.
Pulsed and colour Doppler is 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 can be used to enhance the flow and to assess for reflux. Incompetence is typically defined as a reflux time >0.5s in the superficial system and >1sec in the deep system. [12,19]

Start the examination in the groin at the common femoral vein (CFV) and assess the compressibility and flow. Flow should be spontaneous with respiratory and cardiac modulation. Abnormal flow in the CFV or abnormal superficial veins in the groin/abdomen may be due to iliac vein obstruction and in these cases the iliac veins and inferior vena cava need to be examined. Assessment of the contralateral CFV may be useful as a comparison to aid diagnosis.

Continue to examine the lower limb veins distally, examining the length of the femoral vein (FV), the proximal profunda femoris vein and the popliteal vein as detailed above. The calf veins may be examined as well. If thrombus is identified the extent of the thrombus should be noted. Any reflux must be measured and reported.

Once the deep veins have been assessed, return the transducer to the groin to assess the sapheno-femoral junction and great saphenous system (GSV). Assess the whole length of the GSV for patency and competency. Note the location and extent of any incompetent segments, along with the position of any associated perforators or branches.

Reposition the patient to assess the sapheno-popliteal junction and small (short) saphenous vein (SSV). Locate the SSV in the posterior calf and assess the whole length for patency and competency, noting the location and extent of any incompetent segments, along with the position of any associated perforators or branches. The anatomy associated with the origin of the SSV is very variable and can be commented on if the small (short) saphenous vein is incompetent or if varicose veins arise from this area.

Examine any varicose veins that have not been linked to either the great or small (short) saphenous system to identify any other sources of reflux – i.e. incompetent perforators. This may involve assessment of the medial, anterior, lateral and posterior leg as the refluxing veins are “followed” back to their source.

Assessment of the pelvic veins may be necessary dependent on local protocol. Where transvaginal scanning is required, the provision of a chaperone is required[15,16].

**Vein Mapping**

Vein mapping may be indicated where there is a need to identify whether suitable veins are present for use as conduit for bypass graft surgery. The full extent of the great saphenous vein (GSV) and small/short saphenous vein (SSV) should be examined bilaterally.
With reference to both this document and the Upper and Lower Limb DVT Assessment scan protocol[23] as to technique, the patency and competency of these veins should be assessed and a note made of any wall thickening, thrombus or chronic-post thrombotic scarring. Their typical diameter and depth should be documented segmentally, making note of the location of any major tributaries. The presence or absence of any deep vein thrombosis or deep venous insufficiency within the femoropopliteal segment should also be established, since a vein acting as a collateral in the presence of deep venous disease may not be suitable to use as conduit.
For a lower limb bypass conduit, the target vein should typically be at least 3.0 mm diameter throughout.[24] Competent vein may be favourable to incompetent vein due to structural differences in the vessel wall, although the importance of this should be locally agreed in absence of clear evidence of use or non-use of incompetent vein for conduit.[25] Segments where the vein is <3.0mm diameter should be reported clearly, and focally larger segments should also be noted. Smaller veins may be considered for conduit in some cases (2.5 mm) and should also be recorded. Where a conduit of suitable length and diameter has been established in line with the specific need for the patient as detailed by the referring clinician, it may be reasonable to truncate the scan. Where no suitable conduit has been found, it is helpful to make a similar assessment of the cephalic vein and basilic vein bilaterally as these may offer viable alternatives.

**Suitability for Endovenous Treatment**

NICE recommends the first line treatment for varicose veins to be endothermal ablation or foam sclerotherapy [4]. To assist the referrer in this decision the diameter and depth of the vein and whether it is straight and remains within the fascia plane should be recorded.

**Ilio-Femoral Venous Stenting [21, 22]**

Stenting and/or thrombolysis of the iliac veins is available as a treatment for both acute and chronic ilio-femoral DVT to prevent and improve the symptoms of post thrombotic syndrome. Duplex ultrasound assessment is required to assess for treatment suitability pre-treatment and for surveillance post stenting.

*Pre stenting:*
If an occlusion of the IVC, common or external iliac veins is found, inflow into the occlusion and outflow is essential information to aid decision making by the clinician.
Patency of the common femoral and profunda veins should be assessed and included in the report. Assessment of the femoral and popliteal veins may be added if local policy.

*Post stenting surveillance:*
Patients who undergo ilio-femoral vein stenting should be entered into surveillance. Locally agreed policy should be followed but a recommended surveillance schedule is pre discharge, 2 weeks, 6 weeks, 3 months, 6 months and 12 months with lifelong annual surveillance thereafter[21].
In addition to the stented segments, Inflow and outflow patency (profunda, femoral and popliteal) should be assessed and recorded.
The stents should be imaged using both B mode and colour, looking for wall to wall colour filling, mural thrombus within the stent, under deployment, stent fracture, compression or migration. The degree of narrowing is measured using diameter reduction measurements, but peak flow velocity can also be used with a ratio of in-stent to stent inlet >3.5 or peak flow velocity in the stent >44 cm/s indicating >50% stenosis [21, 22]
Phasicity in the groin should be assessed and documented.
If the stent extends into the IVC, consider imaging the contralateral side as part of surveillance.

**Reporting**

The report is a recording and interpretation of observations made during the course of a duplex ultrasound examination; for general guidance on report writing please review the CSVS service specification document [1] and follow recommendations within the CSVS venous nomenclature statement [20].

For venous duplex examination reports should include:

- 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 GSV due to previous stripping).
- Where thrombus is identified, the location, length/extent, degree of patency and estimated age should be documented.
- Any limitations e.g. if areas in the calf are not visualised due to ulceration
- Schematic diagrams may be useful to support the written report
- Depths and diameters and whether the superficial vein is straight and within the fascia if being assessed for endovenous treatment or sclerotherapy
- Venous stent inflow and outflow patency (profunda, femoral and popliteal) for pre and post stenting surveillance
- Degree of diameter reduction/stenosis within stent if present

Referral of critical ultrasound results should be made to the referring consultant or appropriate medical/surgical team (as per local protocol) prior to the patient being discharged so that treatment plans can be developed, enforced or expedited accordingly.

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**Further Resources**

Society for Vascular Ultrasound Vascular Technology Professional Performance Guidelines Lower Limb Extremity Venous Insufficiency Evaluation
https://www.svu.org/practice-resources/professional-performance-guidelines/

American Institute of Ultrasound in Medicine Practice Guideline for the Performance of Peripheral Venous Ultrasound Examinations
https://www.aium.org/resources/practice-parameters

Australasian Society for Ultrasound in Medicine Policies and Statements D20 Peripheral Venous Ultrasound
https://www.asum.com.au/files/public/SoP/curver/Vasc/Peripheral-Venous-Ultrasound.pdf