

**Review- 2 yearly**

**Date Version Amendments made**

**May 2022 2.1 May 2022 – for review May 2024**

**Lower limb VENOUS duplex: INCOMPETENCE**

**Scanning Protocol for Clinical Vascular Scientists**

**V2.1**

**May 2022**

**lower Limb VENOUS Duplex: incompetence**

**Referrals:**

Indication for Referral:

* Skin changes, venous eczema, hyperpigmenation and venous ulcers
* Swelling
* Pain
* Visible varicose veins
* Venous claudication
* Acute bleeding varicose vein

Contraindications and Limits: (contraindications are few however there are some limitations e.g.)

* Patients with high body mass index
* The presence of ulcers, wounds, bandaging or casts and for patients who have had

recent surgery, ultrasound visualisation may be limited due to oedema, haematoma,

surgical staples, dressings etc

* Patients who are unable to lie still
* Patients who are unable to cooperate due to reduced cognitive functions e.g.

Alzheimer’s or dementia and through involuntary movements

Patients will be referred via the following pathways

* Hospital consultants
* General practitioners
* Acute GP service
* Vascular one stop clinics

Request may come in the following format:

* ORDERCOMS via CRIS system
* Telephone or email requests MUST be followed by a written or ORDERCOMS request

Requests must include:

* Patient name, hospital number and/or date of birth
* Referring consultant/GP
* Relevant patient history
* Relevant clinical symptoms - the examination may be unilateral or bilateral dependent upon clinical symptoms.
* Information required from the investigation

Exam Codes to be used:

* ULVIB
* ULVIL
* ULVIR

Inpatient referrals:

* Usually seen with 1 working day of receipt of request (unless a specific date has been requested)
* Request should include:
  + Ward
  + Name of referrer
  + Bleep or contact number
  + Special considerations i.e. infectious status, O2 requirements
  + Mode of transport

Outpatient referrals:

* Routine appointment: 6 weeks
* Urgent: 2- 4 weeks

One stop clinics:

* Vascular consultants on agreed days/sites and times.
  + Results must be made available immediately

**Examination:**

Equipment: Canon Aplio i700, Canon Aplio i800 or Canon Xario 200

No specific patient preparation is required. Access will be required to the patients legs. Scanning may be difficult in patients with open wounds or increased BMI. Sterile dressings or cling film may allow imaging over broken skin. These tests involve using the probe to apply pressure on the limb to compress the vein, and also augmenting the limb below the level of the probe to check for venous reflux/patency. Careful explanation of this will aid compliance as this can sometimes be uncomfortable for the patient.

Compression stockings and where appropriate other dressings should be removed to enable access to the areas of the limb which require scanning.

The Vascular Scientist undertaking the examination should:

* Introduce themselves
* Confirm patients identity
* Explain why the examination is being performed, the procedure and the duration
* Obtain verbal consent
* Verify that the requested procedure correlates with the patients clinical presentation

Patient Position:

* The patient is asked to remove their clothing to expose the relevant limb to be examined – their dignity and privacy must be maintained at all times (due to the nature of the examination it may be considered necessary to offer a chaperone).
* Position the patient with the leg as vertical as possible – this may be with the patient standing with the leg to be examined externally rotated with the weight kept on the opposite leg or by utilising a tilting couch in the reverse Trendelenburg position.

**Scanning:**

* Select the appropriate frequency probe and appropriate preset depending on body habitus
* Scans should include B-Mode imaging, recording thrombus if seen.
* Colour Doppler and Spectral Doppler assessing flow variability with respiration and response to distal augmentation and/or Valsalva.
* Scan according to the following standard operating procedure – allowing for limitations previously described
* B mode imaging is commenced in the groin identifying anatomy and assessing the Common Femoral Vein (CFV) for compressibility.
* Assess the CFV for spontaneous/phasic flow and/or variation with Valsalva and response to distal augmentation.
* Reflux for ≥ 1sec = significant although in the case of low volume augmentation the return volume may indicate reflux even if <1sec duration.
* Examine the Sapheno femoral junction (SFJ) assessing for response to distal augmentation.
* The Femoral vein (FV) should be assessed throughout the thigh recording images to demonstrate competence/reflux flow and any thrombus noted.
* Return to the Long Saphenous Vein (LSV) and examine it throughout its length commenting on presence of reflux, thrombus, diameter of vein (>12mm is unlikely to be suitable for VNUS), tortuosity, depth, large refluxing branches. Document findings with images.
* Examine the Popliteal (POPV), Gastrocnemius and deep calf veins for evidence of thrombus/reflux.
* Follow the Short Saphenous Vein (SSV) throughout its length documenting the same criteria as the LSV and also commenting on presence/diameter/location of Sapheno Popliteal junction.
* Comment on Giacomini if present.
* If the SPJ and SSV are incompetent confirm any associations with superficial varices as well as association with the Giacomini Vein as this may be a source of recurrence.

The minimum number of images recorded demonstrating the presence or absence of reflux (using colour doppler and/or spectral doppler) should include:

* CFV
* SFJ
* FV
* LSV
* PoPV
* SSV
* Deep calf veins
* Gastrocnemius veins
* Incompetent perforators/other refluxing veins that could not be traced to source

(Any other images recorded are at the discretion of the scanning Vascular Scientist)

**PLEASE NOTE: In some situations, e.g. for more complex or technically difficult cases, these protocols may be altered on an individual basis at the discretion of the Clinical Vascular Scientist who is performing the scan**

**Following the examination:**

* Post processing must be competed on CRIS
* The examinations quality code must be entered
* A typed/dictated report must be generated on CRIs for each attendance on the same day as the examination.
* For In Patient referrals – record the following in the patients notes: Date, Time, Examination and Sign, with a statement: The report for the above examination is available on CRIS/Maxims

**Reporting:**

The report is a recording and interpretation of observations made during the lower limb venous incompetence duplex examination. It should be written by the person undertaking the examination and viewed as an integral part of the whole examination. (If the examination is performed by a trainee, then the report should be verified by the person supervising the trainee, until such times as the trainee has been authorised to report independently.) The report should include:

* Correct patient demographics
* Date of examination
* Examination type
* Status of person reporting the examination
* Which veins have been assessed recording the competency of the veins, extent of incompetent segment, and the AP diameter of the incompetent vein
* Any other information appropriate to each individual patient
* Anatomical variations due to previous procedures
* The presence or absence of phasic flow in the proximal veins
* Presence of any thrombus – identifying the location, length/extent and degree of patency
* Conclusion of findings including any limitations of the examination and recommendation for additional/alternative imaging if deemed necessary by the vascular scientist

Pathway for Lower Limb Venous Duplex imaging/reporting:

* GP / Consultant Outpatient: patient goes home, report generated on CRIS – diagram optional
* Vascular Clinic: patient returns to the clinic, report generated on CRIS – diagram optional
* Inpatient: report generated on CRIS, patient returns to the ward

**If ACUTE thrombus is noted during the examination in the deep veins or superficial veins that is not being treated please discuss the results with the Thrombosis Clinic on ext. 3597**

**Equipment and Environment Cleaning:**

* Under ALL circumstances equipment should be cleaned according to the Trust Decontamination Policy: <http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10167107>
  + Appendix 3: Summary of methods for decontamination of equipment and environment
  + Appendix 4: A-Z Guide to methods of decontamination of equipment
  + Appendix 5: Procedure for manual cleaning
  + Appendix 6: Decontamination of equipment prior to service or repair

**During a Viral Epidemic/Pandemic please refer to the VSU Covid-19 Cleaning Protocol**

**PPE:**

**Please refer to Document Library for current guidance on the use of PPE – NB these are subject to change based on government advice.**

Mask Guidance: [**http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360648**](http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360648)

PPE and Uniform Guidance: [**http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360695**](http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360695)

**Sterile gel should be used in the following settings:**

* If an invasive procedure is likely to be undertaken in the following 24 hours**, including dialysis via a fistula.**
* Where there is contact with or near to non-intact skin (any alteration in skin integrity such as a rash or surgical wound).
* Where the ultrasound examination is near to an indwelling invasive device, such as an intravenous line or suprapubic catheter.
* For examinations on severely immunocompromised individuals (eg. Chemotherapy patients)
* In an intensive-care setting, high-dependency, or equivalent units.

References:

Institute of Physics and Engineering in Medicine/ The Society of Vascular Technology for Britain and Ireland: Vascular Laboratory Practice, Part IV: *Cole, S.E.A, Walker, R.A, Norris, R.*

The Society for Vascular Technology of Great Britain and Ireland; Vascular Technology Professional Performance Guidelines, Venous Lower Limb Reflux Duplex Ultrasound Examination.

<https://www.svtgbi.org.uk/media/resources/Venous_reflux_second_attempt-finalising_4ZsZaIT.pdf>

Vascular Studies Unit Diagnostic Testing Procedures: *Gazzard V*. <http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10254458>

**25 EXAMPLES OF MY VENOUS INSUFFICIENCY SCANS**

1. US Doppler Veins Leg- Insufficiency Lt :

Phasic flow with respiration in the common femoral vein. There is significant reflux in the femoral vein. The popliteal vein is normal.

The LSV is competent in the thigh, and has been harvested in the calf.

The SPJ is incompetent with chronic scarring. The SSV is incompetent with some minor scarring proximally, and in several varicosities. There is a ~8cm segment of straight, 6mm diameter SSV before it becomes small and tortuous upper-mid calf, forming numerous varicosities of which some track medially.

CONCLUSION: DVI (FEMORAL VEIN) AND SVI (SSV).

US Doppler Veins Legs-Insufficiency :

Limited information given on referral what purpose of the scan is, ie. chronic venous insufficiency? Varicose veins? ?Deep veins

1. RIGHT

The deep veins are patent and competent. Poor views below the knee.

The long saphenous vein (LSV) is large (12mm diameter) and incompetent in the thigh, with extensive chronic thrombus/scarring. \*\*\* The patient reports what sounds like an episode of thrombophlebitis (STP) on this side whilst on apixaban around 9 months ago but his history was vague. Below the knee it becomes small, with numerous superficial varicosities.

The short saphenous vein (SSV) is competent proximally, becoming incompetent upper-mid calf where LSV varices join. It becomes bifid for a section here, with both vessels measuring 3-4mm diameter. Knee level SPJ.

There is triphasic flow in the posterior tibial artery.

1. LEFT

No evidence of residual thrombus in the femoro-popliteal deep veins. The mid-distal external iliac vein is also normal (site of previous DVT). The only deep venous reflux is in the popliteal vein. Poor views below the knee, and very tender calf (long standing).

The LSV is incompetent upper thigh (measures 10mm diameter) with some minor scarring. Approx. 10cm distal to the SFJ the LSV becomes smaller (3mm diameter), and competent, with a large superficial branch arising. No thrombus upper-thigh to knee level, but extensive residual thrombus at knee level and in calf varices.

The SSV is competent.

There is triphasic flow in the anterior tibial artery.

CONCLUSION: BILATERAL SUPERFICIAL VENOUS INCOMPETENCE. ?STP WHILST ON APIXABAN. LEFT POPLITEAL VEIN INCOMPETENCE.

Recommend referral to the vascular surgeons for consideration of varicose vein treatment.

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1. US Doppler Veins Leg- Insufficiency Lt :

The deep veins are patent, there is some moderate incompetence of the popliteal vein.

The LSV is incompetent in the thigh from the SFJ, measuring 7mm diameter and is fairly straight. There is scarring/chronic thrombus throughout the thigh LSV, but with a fairly good lumen until knee level where it becomes more extensively thrombosed. In the calf it becomes small with superficial branches (chronic STP noted here too). There is a large incompetent perforator medial lower calf.

The SSV is mostly competent with extensive scarring, becoming incompetent distally where it has a large amount of chronic thrombus. It is 3-4mm diameter but with a small lumen.

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1. US Doppler Veins Leg- Insufficiency Lt :

There is low grade, but significant reflux in the popliteal vein, and moderate reflux in the femoral vein.

The LSV is significantly incompetent in the thigh (again low grade), it is 4-6mm diameter and straight, becoming competent in the calf with branches arising.

The SSV is significantly incompetent, measuring 4mm diameter and is fairly straight, with branches arising at several levels. Knee level SPJ.

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1. US Doppler Veins Leg- Insufficiency Rt :

The above knee deep veins are patent. There is low grade but significant reflux in the popliteal vein. Poor visualisation of the deep calf veins.

The thigh LSV is absent. There are a couple of incompetent superficial branches in the calf but no continuous, patent calf LSV. There is a 3mm diameter incompetent perforator just above the medial malleolus, with varices arising.

The SSV has been successfully treated.

1. US Doppler Veins Leg- Insufficiency Rt :

The deep veins are patent and competent.

The LSV is incompetent upper thigh for approx. 10cm, then becoming competent mid-lower thigh after varices arise. It measures 5-6mm diameter and is fairly straight. It becomes incompetent again below the knee and there is an incompetent perforator lower medial calf.

The SSV is absent (no reported surgery).

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1. US Doppler Veins Leg- Insufficiency Lt :

There is significant reflux in the femoral and popliteal veins. Non-occlusive thrombus seen in the proximal popliteal vein, appearances are indeterminate for age- not classically chronic with echogenicity or recanalisation, so could be acute. I note the history of extensive surgery, patient does not report previous DVT. The deep calf veins could not be visualised due to skin state.

The LSV is significantly incompetent in the thigh, measuring ~4mm diameter. It is superficial, with only slight tortuosity.

The SSV is competent.

1. RIGHT

The deep veins are patent and competent.

The LSV is incompetent in the thigh, measuring 3-4mm diameter and fairly straight (amenable to intervention). It becomes small at knee level and in the calf.

The SSV is competent.

1. LEFT

The deep veins are patent and competent. The superficial veins are also competent.

The patient now has 4 week old wound on her right leg from the biopsy. Recommend referral to vascular surgeons.

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1. US Doppler Veins Leg- Insufficiency Lt :

There is significant reflux with quite extensive scarring in the mid-distal femoral vein and popliteal vein.

Only moderate reflux could be demonstrated in the LSV (<1 sec) (refills via recurrent veins). The SSV is significantly incompetent, with an above knee SPJ approx. 10cm above the knee crease. It is >3mm diameter and fairly straight upper calf, unable to scan distally due to skin state.

There is triphasic flow in the popliteal artery. Biphasic hyperaemic flow in the distal anterior tibial and posterior tibial arteries.

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1. US Doppler Veins Leg- Insufficiency Rt :

The deep veins are patent and competent.

The patient has had previous vein stripping in the 70s. The LSV is initially absent, it reforms upper thigh where it is small (1.6mm diameter) but incompetent. Mid-thigh it increases to 4mm diameter, with a superficial branch. Below the knee there are just tortuous superficial branches, with evidence of past superficial thrombophlebitis.

The ATV is incompetent from the SFJ, where there is a tiny amount of scarring. The ATV has a 14mm dilatation near the SFJ, becoming 8mm diameter below here. It remains straight to mid-thigh where it becomes superficial forming varicosities which track over the knee. There is evidence of past superficial thrombophlebitis in varicosities at knee level, and in the calf.

The SSV is competent. No incompetent perforators seen.

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US Doppler Veins Legs-Insufficiency :

1. Bilaterally the deep veins are patent and competent.

On the right the LSV is significantly incompetent from the SFJ. There is a 30mm dilatation near the groin, then it returns to 10mm diameter upper thigh, before dilating to 33mm mid-thigh. Lower thigh it is 9mm diameter. It remains fairly superficial. Below the knee there are multiple large varices.

The SSV is competent. No incompetent perforators noted.

1. On the left the LSV is significantly incompetent from the SFJ. It is 9mm diameter upper thigh, then dilates to 14mm diameter mid-thigh where it also kinks. In the calf there is evidence of past superficial thrombophlebitis in the LSV and associated varices.

The SSV is competent. No incompetent perforators noted.

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1. US Doppler Veins Leg- Insufficiency Rt :

The deep veins are patent and competent throughout.

The LSV is significantly incompetent in the thigh measuring 3.6mm diameter upper thigh where it is straight. Mid-thigh superficial varicosities arise and the LSV becomes small (2mm) mid-lower thigh, may be borderline incompetent here but is small making assessment difficult. Some of the varices track to behind the knee (site of previous STP), no STP seen today.

The SSV is incompetent proximal to mid calf but small at 2mm diameter with no obvious varices arising, it is competent distally.

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1. US Doppler Veins Leg- Insufficiency Lt :

The deep veins are patent and competent.

The LSV has been previously treated with only a tiny reformed segment mid-thigh. There are numerous recurrent tortuous varicose veins throughout the leg appearing to arise from the SFJ/groin area. No straight segment.

The SSV is initially 2mm and competent, becoming incompetent distally, it is 3-4mm diameter here. There is also an incompetent perforator in the posterior mid calf.

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1. US Doppler Veins Leg- Insufficiency Lt :

There is low grade, but significant reflux in the femoral vein. No evidence of chronic thrombus. The rest of the deep veins are normal.

The long saphenous vein is competent in the thigh. The short saphenous vein is significantly incompetent proximal-mid calf measuring 6mm diameter and following a straight course. There is a competent posterior thigh vein, and a tortuous sapheno-popliteal junction popliteal fossa. Mid-lower calf the SSV becomes competent and tortuous with branches. The long saphenous vein becomes incompetent in the calf with superficial varices.

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US Doppler Veins Legs-Insufficiency :

Difficult scan due to patent immobility and extensive oedema.

Bilaterally the deep veins are patent and competent. Poor views of the deep calf veins but oedema extends above this level.

The LSV and SSV are also competent where seen bilaterally.

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1. US Doppler Veins Leg- Insufficiency Lt :

The deep veins are patent and competent.

The LSV is initially incompetent in the upper thigh from the SFJ, measuring 8mm diameter. Mid-thigh a large 8mm diameter superficial incompetent branch arises and the LSV itself becomes tiny and indistinct. There is only a very small amount of residual chronic STP in the LSV/branches. There is a large incompetent perforator medial mid-calf.

The SSV is competent proximal-mid calf where it is 3-4mm diameter and has a fairly large amount of chronic scarring, distally varices join making it incompetent and tortuous.

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1. US Doppler Veins Leg- Insufficiency Lt :

The deep veins are patent and competent throughout.

The LSV is significantly incompetent in the thigh from the SFJ. It measures 8-9mm diameter throughout the thigh and is fairly straight. Upper calf the LSV itself becomes small and competent and incompetent superficial branches arise.

The SPJ and proximal-mid SSV is 3mm diameter and competent. Just above the level of the ulcer LSV varices connect and make the SSV incompetent mid-distally where it is 4mm diameter. Overall the SSV is fairly straight. Multiple varices seen tracking towards the ulcer from the LSV and mid-SSV.

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1. US Doppler Veins Leg- Insufficiency Lt :

The left external iliac vein remains completely occluded. Common iliac vein not seen. There is only partial recanalisation of the common femoral vein with a large volume of chronic thrombus/scarring. The profunda vein is patent with reverse flow (?collateral pathway). The femoral and popliteal veins are patent with no reflux. Small amount of scarring in the peroneal veins but the deep calf veins appear largely patent.

The LSV is completely chronically occluded throughout, thrombosed varices lower calf also. The SSV is small and competent.

CONCLUSION: CHRONIC OCCLUSION OF ILIAC AND COMMON FEMORAL VEINS. GOOD RESOLUTION OF DEEP VEINS BELOW THE GROIN. OCCLUDED LSV.

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1. US Doppler Veins Leg- Insufficiency Rt :

The deep veins are patent and competent.

The long saphenous vein (LSV) appears to have been successfully treated in the thigh. There is an incompetent anterior thigh vein measuring 5mm diameter, which is fairly straight down to mid-thigh where it becomes superficial and forms varicosities. Some of these track across the knee. No evidence of superficial thrombophlebitis. The calf LSV is incompetent, filled via the thigh varices, it is ~3mm diameter but tortuous.

CONCLUSION: INCOMPETENT ANTERIOR THIGH VEIN AMENABLE TO ENDOVENOUS TREATMENT.

Please refer this patient to vascular surgery who can determine if they think this patients' symptoms are relevant to his veins. I note the symptoms suggest like they could be of mixed aetiology.

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ADDENDUM START by STEPHENS Beth 20-Feb-2023 10:59

The short saphenous vein is absent proximally, and small and competent distally.

1. US Doppler Veins Legs-Insufficiency :

Scanned with limited tilt due to disability therefore unable to completely rule out incompetence.

Bilaterally the deep veins are patent throughout, reduced visualisation lower calf because of the very dense tissue but the deep veins are at least compressible. No obvious reflux.

No obvious superficial venous incompetence either, or STP.

After questioning, the patient did mention that the problems with his legs started ~6 years ago when he had a walker which he used to accidentally repeatedly knock his legs on.

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1. US Doppler Veins Leg- Insufficiency Lt :

Xario machine used (reduced image quality)

There is significant reflux in the femoral, profunda and popliteal veins, with scarring (previous history of DVT). Poor visualisation of the deep calf veins due to skin state.

The LSV and SSV are competent.

There is an incompetent perforator lower medial calf with a couple of associated varices.