

Lower Limb Venous Insufficiency Duplex Scanning Protocol

Vascular Laboratory

Royal Infirmary of Edinburgh

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1.0 Revision of current practice.

With the planned introduction of Consultant led one-stop venous outpatient clinics, patients referred into the department of Vascular Surgery who are deemed suitable for venous treatment will either have their venous ultrasound imaging undertaken by a Consultant Vascular Surgeon or an Accredited Vascular Scientist.

The Vascular Consultants will be performing venous insufficiency ultrasound scans within the outpatient clinic, thus reducing the need for return visits for Vascular Lab imaging and Consultant follow-up. In the Consultant led one-stop clinic, the surgeon will be identifying patients deemed suitable for radiofrequency ablation (RFA) and performing a targeted pre-operative scan of the main superficial venous trunks only.

The Accredited Vascular Scientists perform detailed diagnostic deep and superficial venous insufficiency ultrasound scans within the Vascular Laboratory. It has been identified that performing these detailed scans (and written reports) may not be required for every patient.

In order to ensure that the same standards of scanning are rolled out to all patients based on imaging requirements, and to ensure optimum use of Vascular Laboratory capacity, the Accredited Vascular Scientists and the Vascular Consultants have agreed on the use of two different protocols within the Vascular Laboratory for performing venous insufficiency ultrasound scans.

- 1. Radiofrequency Ablation Protocol (Section 3.0, page 5)**
Targeted scan similar to those performed by the Vascular Consultants in one-stop venous clinics, but with the addition of deep venous imaging.
- 2. Lower Limb Venous Protocol (Section 4.0, page 7)**
Detailed venous insufficiency scans for complex or recurrent veins, significant clinical history (DVT, AV malformations etc) or non standard distribution of Varicose Veins/tributaries.

2.0 Generic requirements for venous insufficiency ultrasound scan.

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

- Symptomatic primary or recurrent varicose veins such as pain discomfort, aching.
- Lower limb skin changes (venous eczema, hyperpigmentation, lipodermasclerosis etc) thought to be caused by chronic venous insufficiency.
- A venous leg ulcer (open or healed).
- Clear history of superficial thrombophlebitis requiring NSAID treatment.
- Previous DVT with suspected post thrombotic limb.
- Episode of venous haemorrhage.

For further information please refer to NHS Lothian Refhelp page for information regarding GP referral into Vascular Surgery.

- [Vascular Surgery](#)

2.2 Contraindications and Limitations

- Max weight limit for Vascular Laboratory ultrasound scans is 180kg/28 stone (max weight limit of scanning couch).
- Casts, dressings, open wounds/ulcers etc can limit visualisation.
- Patients with reduced cognitive functions.
- Limited mobility. For example wheelchair bound patients or hoist transfer patients unable to weight bear for examination. Patients can be scanned whilst seated in their wheelchair however only the Popliteal, calf LSV and SSV can be assessed due to non-dependent leg positioning, and scientist being required to kneel on floor whilst reaching up to scan patient's leg and also manipulating scanner. The ability to provide this limited scan is dependent on the scientist's fitness to scan in this position.

2.3 Equipment and Control Settings.

For detailed information about appropriate equipment and control settings, please refer to IPEM Vascular Laboratory Practice Part 4. Protocol guidelines have also been sought from the Society for Vascular Technology of Great Britain and Ireland. <https://www.svtgbi.org.uk/>

- **ULTRASOUND MACHINE**

An ultrasound machine should be used with B-mode, Colour Doppler and Pulse-wave Doppler functionality.

B-mode should be used to assess vein patency using compressions. It can also be used to comment on presence of thrombus (amount, appearance and level of proximal extension). Colour and Pulse Wave Doppler are used to assess blood flow characteristics within the veins, quantify and evidence reflux time.

- **ULTRASOUND PROBES**

A high frequency linear probe (~13-5MHz) is required for assessment of superficial veins. A lower frequency linear probe linear probe (~9-4MHz) is used to assess deep veins. For difficult imaging (obese patients, adductor canal, and limited patient mobility) where linear probes cannot provide optimal imaging, a deep curve-linear probe can be used (~min 3MHz).

- **EXAMINATION COUCH**

An examination couch should be capable of tilting to at least 30 degrees into the reverse trendelenberg position. It must also be height adjustable with a platform at the foot end.

- **SCIENTIST'S CHAIR**

The scientist's chair should provide good lumbar support, be height adjustable and allow the AVS to move close to the examination couch allowing a straight back position to be maintained throughout and prevent twisting during calf augmentations.

- **AIR CONDITIONED ROOM**

Due to the nature of the examination increasing patient's chances of experiencing a Vaso-Vagal (fainting) episode, and the physical work undertaking by the scientist, the room must have air conditioning to allow for temperature regulation.

2.4 PATIENT PREPARATION and POSITIONING

The patient should be asked to confirm their name and date of birth prior to the scan, matching these details with both the referral and the ultrasound machine.

The Scientist should introduce themselves, and explain the scan to the patient, addressing any concerns before commencing. Consent should be sought from the patient to perform the scan.

The patient should be asked to remove their outer clothing and lie on the examination couch. The couch is then tilted into the reverse trendelenberg position (at least 30 degrees tilt must be achieved).

The patient should be encouraged to take most of their weight on the contra-lateral leg, and relax/externally rotate their symptomatic leg.

Please see the NHS Policy on Chaperones, available on the NHS Lothian intranet site.

If the patient has numerous Vaso-Vagal episodes during the examination consider asking a second member of staff to attend if there are concerns over patient and staff safety. Attempt limited scan with patient in seated position if appropriate.

If it is not safe to continue it may be necessary to rebook the scan for a later date, ensuring that the patient has had something to eat and drink prior to the examination.

Following the examination, the patient should be informed about the follow-up of the results. Usually this involves a return clinic appointment with the patient's Vascular Consultant however can be via written correspondence to the patient or the patient's GP instead.

2.5 EXAMINATION-Venous flow is assessed for the 7 qualities listed below:

- **Competency** - use calf compression to augment flow, and look for reflux >0.5 seconds on both colour and spectral Doppler.
- **Patency** - use B-mode and colour Doppler to ensure the vein is open.
- **Compressibility** - ensure that the vein collapses with external pressure. If not, thrombus should be suspected.
- **Phasicity** - ensure that proximal deep veins are phasic with respiration.
- **Spontaneity** - ensure that there is an audible presence of a spontaneous venous signal.
- **Augmentation** - flow should audibly and visibly increase on manual distal compression.
- **Nonpulsatility** – veins should be nonpulsatile. If pulsatility is noted, A-V malformation, dialysis and fluid overload are all possible causes.

3.0 Radiofrequency Ablation Protocol

ORDER OPTIONS

- **Lower Limb Venous (RFA protocol-Bilateral)**
- **Lower Limb Venous (RFA protocol-Single)**

As the time allocated to scans using the RFA protocol is shortened, the deep veins, long saphenous vein, anterior thigh vein, short saphenous vein and Giacomini vein are assessed only.

Any patients who do not fit into the below criteria must be referred for a general 'Lower Limb Venous' ultrasound scan (extended time for more detailed examination of tributaries and perforators).

Referring the patient under the incorrect protocol will result in the patient's appointment being rescheduled for a later date with the correct appointment time allocated to the appropriate protocol type.

3.1 Criteria for 'RFA PROTOCOL'

1. Indication of main superficial truncal (LSV, Anterior Thigh Vein, SSV, Giacomini vein) venous insufficiency where the main truncal veins are considered suitable for RFA. No imaging of tributaries/perforators is required.
2. If, following clinical assessment, the veins are suspected to be unsuitable for RFA, or a more detailed scan is required, please refer patient using the **Lower Limb Venous protocol**. This protocol will look for any contributing tributaries and perforators also.

3.2 DEEP VEINS-EXAMINATION

As the Vascular Lab scan is considered a diagnostic scan, the deep veins will be included in the Vascular Laboratory RFA protocol to rule out acute or chronic DVT/scarring and presence of reflux that may be contributing to symptoms of venous hypertension (as per SVT guidelines).

This may determine whether the patient would benefit from ongoing compression bandaging/stockings regardless of status of superficial veins or subsequent surgical treatment.

COMMON FEMORAL VEIN (CFV)

- Start at the groin and image the TRANSVERSE 'Mickey-mouse' configuration (CFV-head, CFA/LSV as ears) in *B-Mode*. Confirm compressibility of CFV.
- Assessing the CFV in LONGITUDINAL plane, confirm flow characteristics using *Colour* and *Pulse Wave Doppler*. Assess for 7 qualities listed in section 2.5, page 3. If abnormal CFV waveforms are present then continue to scan up into the iliac veins and IVC to rule out proximal venous obstruction.

SUPERFICIAL FEMORAL (SFV), PROFUNDA FEMORAL VEIN origin (PFV), POPLITEAL VEIN (PopV).

- In TRANSVERSE views using *B-mode*, perform compressions every 2-3cm along the SFV, PFV origin & PopV to confirm patency and exclude thrombus/scarring.
- In LONGITUDINAL views assess the flow characteristics along the SFV, PFV origin and PopV in *Colour* and evidence augmentation with the use of *PW Doppler*. Assess for qualities listed in section 2.5, page 3).

REFLUX IS DEFINED AS RETROGRADE FLOW of >0.5 SECONDS FOLLOWING DISTAL CALF COMPRESSIONS TO AUGMENT VENOUS FLOW.

Use Pulse wave doppler to quantify and evidence amount of reflux.

3.3 SUPERFICIAL VEINS-EXAMINATION

The purpose of the RFA protocol is to assess for reflux in the main superficial truncal veins that RFA targets. These are:

- **Sapheno-Femoral Junction and Long Saphenous Vein (LSV).**
The **Anterior Thigh Vein (ATV)** will also be assessed if present and incompetent.
- **Sapheno-Popliteal Junction and Short Saphenous Vein (SSV).**
The **Giacomini Vein** will also be assessed if present and incompetent.

The scope of the RFA protocol is to determine whether the above veins are incompetent, straight, positioned within the fascia and deep enough from the skin surface to allow a safe and effective RFA procedure.

Use B-mode, Colour and Pulse Wave Doppler to assess for the 7 qualities listed in section 2.5, page 3.

- Assess the plane of the **SFJ/LSV & SPJ/SSV** in TRANSVERSE VIEWS and perform compressions every 2-3cm to confirm patency.
- In LONGITUDINAL PLANE, assess the flow characteristics within the **SFJ/LSV & SPJ/SSV** whilst performing distal calf compressions. Evidence augmentation using Pulse Wave Doppler.
- Perform the above for incompetent Anterior Thigh Branch or Giacomini veins.
- Calibre of incompetent truncal veins (RFA requires superficial venous AP diameter of $\geq 3\text{mm}$).
- Depth of incompetent truncal veins from skin surface (RFA requires a depth of $\geq 0.5\text{cm}$ from skin surface).
- Comment on straight/tortuous nature of incompetent truncal veins.
- Comment on position of main truncal veins in relation to fascia.

The Vascular Surgeons have agreed to, and acknowledge that the RFA protocol will not assess or comment on the presence of main truncal varicose veins/tributaries or perforators.

3.4 INTERPRETATION & REPORTING

Document the following...

- Patency and competency of CFV, SFV, PFV origin, PopV, SFJ/LSV and SPJ/SSV.
- Any abnormal findings in relation to the 7 qualities listed in section 2.5, page 3.
- Any perceived issues relating to RFA procedure.
- Calibres and depths of incompetent superficial trunks.
- If incompetent, measure calibres and depth of Anterior Thigh Vein and Giacomini vein. Document distance of these veins from the SFJ/SPJ (RFA wire is usually withdrawn a minimum of 2cm from junctions for ablation procedures).
- Reasons for sub-optimal scan.
- Any other findings/abnormalities (i/e Bakers cyst).

4.0 LOWER LIMB VENOUS PROTOCOL

ORDER OPTIONS

- Lower Limb Venous (detailed-Bilateral)
- Lower Limb Venous (detailed-Single)

4.1 CRITERIA for LOWER LIMB VENOUS PROTOCOL

- Patients where the main truncal veins are not expected to be suitable for RFA procedure.
- A more detailed scan of the varicose veins is required, including assessment of incompetent tributaries or perforators.
- Complex/unusual distributions of varicose veins not associated with main truncal veins.
- Consideration for dual treatment (i.e. RFA plus stab avulsions or foam sclerotherapy).

4.2 DEEP VEINS-EXAMINATION

COMMON FEMORAL VEIN (CFV)

- Start at the groin and image the TRANSVERSE 'Mickey-mouse' configuration in *B-mode*. Confirm compressibility of CFV.
- Assessing the CFV in LONGITUDINAL plane, confirm flow characteristics using *Colour* and *Pulse Wave Doppler*. Assess for 7 qualities listed in section 2.5, page 3. If abnormal CFV waveforms are present then continue to scan up into the iliac veins and IVC to rule out proximal venous obstruction.

SUPERFICIAL FEMORAL (SFV), PROFUNDA FEMORAL VEIN origin (PFV), POPLITEAL VEIN (PopV).

- In TRANSVERSE views using *B-mode*, perform compressions every 2-3cm along the SFV, PFV origin & PopV to confirm patency and exclude thrombus/scarring.
- In LONGITUDINAL views assess the flow characteristics along the SFV, PFV origin and PopV in *Colour* and evidence augmentation with the use of *PW Doppler*. Assess for qualities listed in section 2.5, page 3.
- **REFLUX IS DEFINED AS RETROGRADE FLOW of >0.5 SECONDS FOLLOWING DISTAL CALF COMPRESSIONS TO AUGMENT VENOUS FLOW.
Use Pulse wave doppler to quantify and evidence amount of reflux.**

4.3 SUPERFICIAL VEINS-EXAMINATION

The purpose of the Lower Limb Venous protocol is to assess for native truncal veins or neovascularised junctions/veins alongside any incompetent tributaries or perforators contributing to new or worsening varicose veins.

In cross-section, using B-mode, image the SFJ/LSV territory to the ankle to assess for any native or neovascularised veins. Assess for any tributaries or perforators. Extend scan to include the anterior/lateral and posterior thigh any additional incompetent perforators or tributaries.

In longitudinal orientation, image any SFJ, LSV, tributaries and perforators and assess venous flow for the 7 qualities listed above (section 2.5, page 3) using Colour/Pulse Wave Doppler.

Place probe at the knee crease and image in cross-section, using B-mode, the SPJ/SSV territory to the ankle, looking for tributaries and perforators.

In longitudinal orientation, image the SPJ, SSV, tributaries and perforators and assess venous flow for the 7 qualities listed above using Colour/Pulse Wave Doppler.

4.4 INTERPRETATION & REPORTING

Document the following...

- Patency and competency of CFV, SFV, PFV origin, and PopV.
- Patency and competency of native or neovascularised superficial veins and their feeding varicose veins, tributaries or perforators.
- Document location and diameter of neovascularised junctions (?surgically tie off).
- Document location and diameter of incompetent varicose veins, tributaries or perforators (?avulsions, foam sclerotherapy etc).
- Any abnormal findings in relation to the 6 qualities listed in section 2.5, page 3.
- If native veins present or neovascularised veins possibly suitable for RFA, document calibres and depths from skin surface alongside whether the veins are straight and positioned within or outside fascia.
- Reasons for sub-optimal scan.
- Any other findings/abnormalities (i/e Bakers cyst).

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