



VASCULAR STUDIES UNIT

Lower Limb Venous – Doppler Ultrasound Examination

Introduction and Scope:

Venous insufficiency can cause significant morbidity to patients and negatively impact their quality of life. It can occur in the deep and/or superficial venous systems of the lower limbs and a Doppler ultrasound examination can provide information on the burden of any venous reflux along with anatomic information useful for planning treatment. It is also useful for establishing patency of the iliofemoral veins post thrombolysis and/or stenting.

Indications for scanning

- Suspicion of chronic venous insufficiency (CVI)
- Ongoing symptoms following treatment for deep vein thrombosis
- Known congenital disorder e.g. Klippel-Trénaunay-Weber Syndrome (KTS)

Contraindications and Limitations

For assessment of venous reflux, the clinical vascular scientist (CVS) must evaluate the patient's capacity to stand and weight-bear for an extended period before the examination is carried out. If the patient is deemed unfit in this manner, a limited study may be carried out at the discretion of the CVS, however the CVS must be mindful not to place themselves or the patient at risk of injury while adapting positions to accommodate limited mobility.

The CVS must also be aware of the possible syncopal episodes patients may experience as a result of the physiologic changes that take place during the examination. The CVS should monitor the wellbeing of their patient throughout the study to reduce any risk of syncope.

Extensive bowel gas, lower limb oedema, poor skin condition and tender legs may cause limitations to examination. Patients who are unable to cooperate due to cognitive function, such as dementia, involuntary movements, or due to reduced mobility meaning they cannot lay supine, may also be unsuitable for the examination.

Referral pathways:

- Routine referrals should be made by a member of the patient's care team via EPR.
- Urgent referrals should only be made when there is evidence of bleeding or infected varicose veins. A member of the patient's care team should make the referral via EPR and follow up with a phone call to the Vascular Studies Department



Equipment:

Approved Vascular Studies instrumentation should be used for this examination. Please see 'Equipment Schedule' document.

Preparation:

It is the duty of the Clinical Vascular Scientist (CVS) to ensure that both the patient and the equipment are positioned correctly to minimise risk of injury to themselves and the patient, and to take precautions to avoid unnecessary strain on the back and/or provocation of work related upper limb disorders (WRULD)². The patient's dignity and privacy must be maintained at all times. It may be necessary to offer a gown and/or a chaperone.^{i,3}

Consent:

It is a legal and ethical principle that valid consent be obtained before starting a physical investigation. This principle reflects the right of patients to determine what happens to their own bodies, and is a fundamental part of good practice. It is the responsibility of the CVS carrying out the investigation to ensure verbal consent is obtained¹.

Clinical Governance:

It is the duty of all staff to ensure that the patient's right to confidentiality is always observed and upheld, both during and after their hospital visit and that all patient identifiable records are stored in accordance with trust guidelines and Caldicott Principles.⁴

Method:

As with all scanning protocols the following should be used as a guide – It is the duty of the CVS conducting the study to make appropriate modifications to the examination based on their professional judgement and on the mental and physical health of the patient.

The patient is asked to remove clothing to expose the area for examination.

To assess for lower limb venous reflux, the patient should be examined standing with leg relaxed to facilitate distention of the veins and optimise visualisation. The target leg is slightly bent and externally rotated for optimum access to the medial aspect of the leg. A limited study can take place if the patient is unable to stand for long periods and it may be appropriate for the patient to be sat on a raised bed while assessing the calf veins, however it should be noted that results obtained when patient is not standing may yield a lower sensitivity.

The following superficial and deep veins should be identified and checked for unusual anatomy (e.g. absent popliteal vein or popliteal aneurysm), reflux, post thrombotic scarring and thrombus:

- saphenofemoral junction (SFJ)
- great saphenous vein (GSV)
- anterior accessory saphenous vein (AASV)
- saphenopopliteal junction (SPJ)



- small saphenous vein (SSV), thigh extension of small saphenous vein (TE-SSV) or Giacomini vein
- common femoral vein
- proximal profunda femoris vein
- femoral vein
- popliteal vein
- posterior tibial veins
- peroneal veins

Please note that venous anatomy can be highly variable and it is important to have a full understanding of possible variants.

Additionally, the leg should be visually examined to identify the distribution of any notable varicose veins. Any varicose veins found visually or on duplex should be traced to identify their source. This is to allow the CVS to investigate for any incompetent sources not listed in the above stated veins (e.g. a lateral thigh perforator or varices from a pelvic source).

To assess for superficial and deep venous reflux, colour and spectral Doppler simultaneous with distal augmentation is used. B-mode and compression techniques may also be used to aid identification of any post-thrombotic scarring or thrombus.

Where the GSV or SSV is found incompetent the following is important to determine: presence of scarring or thrombus, vessel calibre, whether the vessel remains within its fascia and whether there are any segments of marked tortuosity. If vein depth may cause difficulty for endovenous ablation (e.g. if the vein courses very superficial) this should also be noted.

For any incompetent perforators or branches found, their anatomical positioning and calibre should be determined (e.g. '3 mm incompetent perforator located 10cm above the medial femoral condyle').

For any vascular malformations, such as AVM / KTS, deviations from the above method are to be expected. Please discuss with the referring clinician for exact questions and requirements to aid scanning method and see 'AVM' protocol for further information.

Measurements and Grading Criteria:

Examination of venous stenting

Grading of venous stent stenosis is not well established. The CVS should take care to reflect this when reporting. Taking multiple diameter reduction measurements in various planes may be a useful technique to calculate a percentage stenosis as well as comparing contralateral venous haemodynamics.

Assessment of venous reflux

Venous Reflux Criteria ^{5, 6, 7}

<0.5sec reflux - normal

>0.5sec reflux within a superficial vein – suggests incompetence

>1.0secs reflux within a deep vein – suggests incompetence



Grading criteria may not be applicable in the presence of unusual anatomy, e.g. very large vessel, or vascular malformations, and is at the discretion of the CVS to use the above criteria as a guideline.

Where GSV and SSV incompetency is identified, any suitable segment of these truncal veins that may or may not be a good target for endothermal ablation should be established. An anatomically suitable segment should be straight, of good diameter (at least 3mm) and absent of post thrombotic scarring or thrombus. Segments smaller, more tortuous, or measuring >12mm in calibre should be highlighted along with any segments that course superficial to the fascia. If <12cm length of truncal vein appears suitable for ablation the approximate suitable length should be documented.

Reporting:

The status of the SFJ, GSV, SPJ, SSV and all deep veins, along with any other incompetent vein should be documented. In the event of truncal superficial venous insufficiency, the anatomic suitability for endothermal ablation should be documented. The presence of any incompetent perforators of 3mm diameter or greater should be documented.

Any absent superficial or deep veins should be stated and any anatomical variants/abnormalities documented where appropriate. A list of veins not examined and any limitations experienced should also be documented.

Abnormal findings may benefit from an accompanying diagrammatic illustration at the discretion of the CVS. This should be uploaded to EPR and the written report should direct the clinician towards it.

Reports should answer any specific diagnostic questions raised on the referral. As a minimum, images of the SFJ and SPJ as well as any disease should be uploaded to PACS, with other images stored as an aide memoire at the discretion of the CVS.

Urgent findings, such as acute thrombus, should be reported verbally to the on call Vascular Registrar via bleep 2977 as well as documented in the report on EPR.

References

¹ United Kingdom Association of Sonographers (UKAS), 2008, Guidelines for Professional Working Standards Ultrasound Practice, accessed at: www.sor.org/learning/document-library

² Society of Radiographers, 2002, The Causes of Musculoskeletal Injury Amongst Sonographers in the UK Society of Radiographers, accessed at: www.sor.org/learning/document-library

³ Society for Vascular Technology Professional Standards Committee, 2020, Consent and Chaperone Guidelines, accessed at: https://www.svtgbi.org.uk/media/resources/Chaperone_2020.pdf

⁴ Department of Health and Social Care, 2013, Caldicott Review: information governance in health and social care, accessed at: <https://www.gov.uk/government/publications/the-information-governance-review>

⁵ Labropoulos N, Tiongson J, Pryor L, et al. Definition of venous reflux in lower-extremity veins. J Vasc Surg 2003;38:793-8. 10.1016/S0741-5214(03)00424-5

⁶ Gloviczki P, Comerota AJ, Dalsing MC, et al. The care of patients with varicose veins and associated chronic venous diseases: clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum. J Vasc Surg 2011;53:2S-48S. 10.1016/j.jvs.2011.01.079



⁷ Wittens, C., et al., 2015, Editor's choice-management of chronic venous disease: clinical practice guidelines of the European Society for Vascular Surgery (ESVS). *European Journal of Vascular and Endovascular Surgery*, 49(6), pp.678-737.

Other resources

Coleridge-Smith P et al, 2006, Duplex Ultrasound Investigation of the Veins in Chronic Venous Disease of the Lower Limbs – UIP Consensus Document. Part I. Basic Principles, *Eur J Vasc Endovasc Surg*, 31: 83-92

Cavezzi A et al, 2006, Duplex Ultrasound Investigation of the veins in Chronic Venous Disease of the Lower Limbs – UIP Consensus Document. Part II. Anatomy, *Eur J Vasc Endovasc Surg*, 31: 288-299

Caggiati A et al, 2005, Nomenclature of the veins of the lower limb: Extensions, refinements, and clinical application, *Journal of Vascular Surgery*, Volume 41, Issue 4, 719 - 724

Hartshorne T & Goss D, 2010, Anatomy of lower limb venous system and assessment of lower limb venous insufficiency, *Vascular Ultrasound: How, Why and When*, 3rd Edition, Edinburgh, Elsevier. P193-233