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Lower limb venous ultrasound		Dec 2021	1.3

Scope & purpose

Lower limb venous duplex ultrasound examinations are carried out to assess patency and competency of the deep veins and superficial veins.

Common indications for performance of this examination can include:

- Visible varicose veins
- Bleeding varicose veins
- Leg swelling and/or ache
- Venous ulcer
- Venous eczema
- Iliac vein stents
- Previous deep vein thrombosis (DVT)

Personnel

Clinical vascular scientists (CVS), including trainees.

Principles / performance characteristics

To determine the patency and competency of deep veins and superficial veins of the lower limbs and abdomen; using B-mode, colour and spectral Doppler.

Service users & background

Patients with any of the indications outlined in 'scope and purpose' may be referred by a vascular surgeon for a lower limb venous duplex. This diagnostic investigation aims to establish if venous disease is a possible cause for their symptoms and establish the patient's amenability for intervention (ref 1).

All patients referred for a lower limb venous incompetency scan will have a groin to ankle assessment of their deep and superficial veins following SVT guidance. However, if clinically indicated the IVC and iliac veins will also need to be imaged to determine patency. Clinical indications for iliac imaging include the following:

- Requested by the clinician
- Any thrombus or scarring in the CFV
- Aphasic flow in the CFV
- Any large collaterals draining flow up into the pelvis
- Left leg unilateral limb swelling or heaviness in the absence of any lower limb venous incompetency (to check for May-Thurner Syndrome)
- Any suggestion that there may be a proximal venous obstruction
- IVC-Iliac vein stent

Deep veins in the calf will not be routinely imaged unless the patient is C5 or C6 (has an ulcer or had a previous ulcer). Other considerations for scanning the calf include the following:

- Popliteal vein incompetence and/or scarring
- History of DVT

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- Absence of any other lower limb venous disease
- If it is thought this would add to the clinical picture

There are few contraindications for lower limb venous duplex ultrasound; however, limitations may include the following:

- Bowel gas
- Raised BMI
- Severe oedema / swelling
- Dressings, casts, open wounds, staples, haematoma etc.
- Acoustic shadowing
- Patients who are unable to stand
- Patients who are unable to cooperate due to reduced cognitive functions e.g. Alzheimer's or dementia and through involuntary movements
- Examinations undertaken at the patient's bedside may be limited due to equipment and room dimensions
- Patient discomfort

Facilities, equipment & special supplies

Duplex ultrasound machine with both linear and curvilinear transducers available. There should be a selection of transducers delivering a wide range of frequencies (high and low).

Ultrasound gel to provide a couplant between transducer and patient.

Specifically designed Charing Cross vein stand - Ideally the patient should stand on an elevated stand in front of the bed. The bed is raised to its highest position. The stand should have side supports and arm rests.

Examination couch should be height adjustable. The CVS's chair should provide good lumbar support, be height adjustable and allow for the CVS to move close to the examination couch.

Cleaning materials should be available in line with local and manufacturer's guidelines, these are available either in each procedure room or located in the laboratory store room.

Calibration

Across all sites annual calibration and safety checks of the ultrasound equipment are performed by Clinical Engineering (Trust contract with GE Healthcare).

Quality control

Second opinions from CVS colleagues are requested routinely if clarification is sought.

Trainee vascular scientists have all lower limb venous scans checked until they are signed off by a senior colleague for competency.

Environmental & safety controls

Infection control procedures followed in accordance with Trust infection control and risk

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assessment policies – Please see ‘Personal Protective Equipment (PPE) for infection prevention and control’ policy, ‘Hand Hygiene’ policy and ‘Staff Risk Assessments’ which are all available through the Trust Intranet.

Tristel wipes are for cleaning the ultrasound machines and probes after patient use. Universal Clinell wipes are for cleaning all other equipment. Where high risk infection presents or post-op wounds are present use probe covers with sterile gel or Tegaderm dressings, in addition to routine cleaning.

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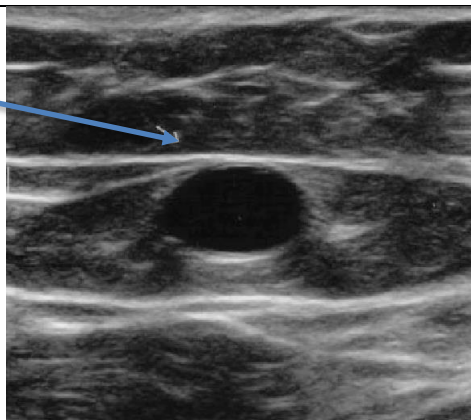
Lower limb venous ultrasound procedure

	Preceding document: <i>VAS-MP-6 Patient management</i>
1.	<p>Venous nomenclature</p> <p>The following venous nomenclature must be followed:</p> <p><u>Deep veins</u></p> <p>Common femoral vein (CFV)</p> <p>Femoral vein (FV)</p> <p>Deep femoral vein (DFV)</p> <p>Popliteal vein (PV)</p> <p>Soleal vein (medial or lateral)</p> <p>Gastrocnemius vein (medial or lateral)</p> <p>Posterior tibial veins</p> <p>Peroneal veins</p> <p><u>Superficial veins</u></p> <p>Great Saphenous vein (GSV)</p> <p>Small saphenous vein (SSV)</p> <p>Anterior accessory of the great saphenous vein (AAGSV)</p> <p>Posterior accessory of the great saphenous vein (PAGSV)</p> <p>Cranial extension of the small saphenous vein (CESSV) – unless continuation with the GSV is noted, in this case can be referred to as Giacomini vein</p>
2.	<p>Ask the patient to remove their clothing to expose their legs.</p> <p>Venous duplex scans are preferably performed with the patient standing on the vein stand, with the CVS seated immediately in front of the patient. If a stand is unavailable or patient is unable to safely get onto the stand, the scan can be performed on a tilt table. In all cases, the most physiological assessment of the lower limb venous system is with the limb maximally dependent. The patient is asked to weight bear on the contralateral leg and externally rotate the knee. Slightly raising the heel (~1cm above the horizontal) of the leg to be investigated can also improve augmentation of flow and demonstration of reflux, and can be used if required. It is important that the muscles of the leg under investigation are relaxed.</p> <p>As fainting/light-headedness can occur during the scan keep an eye on the patient and regularly check they are OK, looking for signs that they may be feeling faint (such as mentioning they are getting hot, fidgeting/shifting their weight a lot, stopping talking or talking a deep sigh etc.). Due to this, it is very important to set up the stand in front of a raised scanning bed with a minimal gap between the bed and the stand.</p>
3.	<p>Scanning the deep veins (fem-pop):</p> <p>Ideally, the patient should be standing and facing towards the CVS to start. Place the probe over the inguinal triangle. Optimise your image in B-mode and switch on colour mode. Identify key anatomical structures such as Common Femoral Artery (CFA) and CFV. Move marginally distally and identify the sapheno-femoral junction (SFJ), achieving the characteristic 'Mickey Mouse' image.</p> <p>Turn the probe through 90°. Optimise your image in B mode, identifying CFV, FV and</p>

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	<p>DFV. Turn colour Doppler back on and observe phasic and spontaneous flow in the CFV. Augment flow in the veins by squeezing the calf or lower thigh of the patient to assess for patency and reflux in the CFV and DFV. Move medially down the leg and continue to assess the full length of the FV. To assess the popliteal vein, ideally the patient is standing and facing away from the CVS with a relaxed knee. The entire length of the popliteal vein should be assessed. Observe and document any reflux, depicted on the drawing template as a downward arrow (if necessary check with the spectral Doppler that the reflux is >0.50sec - ref 2). Observe and document any normal flow, depicted on the drawing template as an upward arrow (reflux <0.5seconds represents a competent vein). Observe and document on the drawing template any thrombus (fill in the vein). Document any channelling or scarring. Document with additional drawing on the template any bifid veins.</p> <p>Compression of the deep veins in B-mode and transverse plane should be performed in the presence of thrombus or scarring, or suspicion of thrombus, to confirm patency. If thrombus is identified or suspected the DVT protocol should be followed.</p> <p>The machine controls should be optimised continually throughout the scan to obtain the best image to aid with diagnosis.</p>
4.	<p>Scanning the Great Saphenous Vein (GSV):</p> <p>Ideally, the patient should be standing and facing towards the CVS. Identify the CFV and SFJ in B-mode. Turn on colour Doppler and assess for reflux at the level of the SFJ (in transverse or longitudinal plane). Then scan the GSV in transverse plane and regularly check for reflux, with the probe at an angle to the vein, by slowly moving the probe distally. Key regions to check for reflux include before and after any tributaries. Scan down from the SFJ down to the medial malleolus. If the GSV is incompetent, measure and document (in mm) the maximum external diameter of the GSV in the proximal, mid and distal thigh and proximal, mid and distal calf. If the competency appears marginally incompetent then check in longitudinal view (if necessary check with the spectral Doppler that the reflux is >0.50sec - ref 2).</p> <p>Document any incompetent tributaries and follow the incompetence to its termination (e.g. peters out, re-joins the GSV or a draining perforator). Measure and document the size of any major dilatations.</p> <p>Document any aberrant anatomy – most commonly, the GSV rises superficial to the fascia and can remain straight. Document if /where it re-enters the fascial plane.</p>

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	<p>This arrow indicates the fascial plane, if the GSV sits above this line, then it is sitting outside of the fascial plane</p>  <p><i>Image taken from Semantic Scholar 2020 (ref 3).</i></p>
5.	<p>Scanning the Anterior Accessory of the Great Saphenous Vein (AAGSV):</p> <p>Ideally, the patient should be standing and facing towards the CVS. Where evident, scan the vein in transverse plane, observe and document as with the GSV. If incompetent, document its length within the fascial plane. For ablation a length >5cm within the fascia is required. It may be more appropriate to squeeze the thigh to obtain sufficient flow augmentation.</p>
6.	<p>Scanning the Small Saphenous Vein (SSV):</p> <p>Ideally, the patient should be standing and facing away from the CVS. First identify the SSV in the popliteal fossa. Scan the vein in transverse and follow the vein up to and including its insertion with the popliteal vein, if evident. Scan the SSV throughout its entire length and assess in longitudinal and transverse views, in B-mode and colour Doppler, where appropriate. Check for reflux in colour Doppler in transverse view at regular intervals, using spectral Doppler in longitudinal vein when necessary. Document key features as for the GSV, and the presence or absence of the SPJ.</p> <p>Identify the presence of the cranial extension of the small saphenous vein in the popliteal fossa and assess for reflux. If reflux is identified in the CESSV, scan as appropriate to identify the source.</p>
7.	<p>Perforators:</p> <p>Perforators should be checked for and tested for reflux (>0.50sec - ref 2). If an incompetent perforator is identified using colour and/or spectral Doppler, this and any incompetent tributaries should be documented. The maximum external diameter of this perforator should be documented in mm at the point of piercing the deep fascia.</p>
8	<p>Scanning the deep veins of the calf (if indicated):</p> <p>Ideally, the patient should be standing and facing away from the CVS to image the gastrocnemius and soleal veins. Identify the gastrocnemius and soleal veins in transverse view with B-mode. Turn on the colour Doppler and check for patency and reflux.</p> <p>Ideally, the patient should be standing and facing towards the CVS to image the</p>

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	<p>posterior tibial and peroneal veins. Identify the veins in B-mode in longitudinal view with their accompanying arteries. Turn on colour Doppler. Scan the full length of the veins in longitudinal view to check for patency and reflux.</p> <p>Compression of the deep veins in B-mode and transverse plane should be performed in the presence of thrombus or scarring, or suspicion of thrombus, to confirm patency. If thrombus is identified or suspected the DVT protocol should be followed.</p>
9.	<p>Scanning the IVC and iliac veins, if indicated, may be unilateral or bilateral depending on indication:</p> <p>The patient should be in the supine position. Using the curvilinear, low frequency probe, turn on colour Doppler and examine the inferior vena cava (IVC), common iliac vein (CIV), internal iliac vein (IIV) and external iliac vein (EIV). If imaging the left CIV, take external diameter measurements at rest, if <5mm measure with a deep breath hold.</p> <p>Check the phasicity in the EIV.</p>
10.	<p>Iliac vein stents:</p> <p>Scan the iliac vein stent/s in both longitudinal and transverse planes with colour Doppler and in B-Mode, paying careful attention to the walls of the stent/s to determine the presence of any mural thrombus. In the presence of thrombus, document the diameter reduction.</p>
	<p>Subsequent documents: <i>VAS-MP-6 Patient management, VAS-MP-1 Results processing</i></p>

Reporting

The diagrammatic report is a record and interpretation of observations made during the lower limb venous duplex ultrasound examination; it should be written by the CVS undertaking the examination.

The report should include correct patient demographics, date of examination, examination type, the name and status of the CVS and any clinical history deemed relevant.

All disease (including patency and competency) or variable anatomy must be drawn on the diagram. If any section of a named vein has not been identified, document as 'not evident' on the report.

If any veins are not imaged then this must be clearly evidence on the diagram.

If DVT present, follow the DVT protocol - [VAS-DP-2] and the referring doctor should be contacted immediately if acute thrombus is suspected.

All diameter measurements to be documented in millimetres.

Any incidental findings should be documented and further imaging recommended when clinically appropriate.

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The report is then scanned onto the shared drive for access across site.

References

1.	VAS-ED-12. Vascular Technology Professional Performance Guidelines Lower Limb Venous Reflux Duplex Ultrasound Examination.
2.	Thrush, A. and Hartshorne, T. (2010). <i>Vascular Ultrasound: How, why and when</i> , 3rd edn, Elsevier Limited: London (p209)
3.	Meissner, M. (2005) Lower extremity venous anatomy. <i>Seminars in Interventional Radiology</i> . 22(3):147-56.