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Lower limb venous ultrasound		Jul 2021	1.2

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
- Iliac vein stents
- Previous deep vein thrombosis (DVT)
- Suspected DVT or suspected superficial thrombophlebitis

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.

All patients referred for a lower limb venous insufficiency 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 insufficiency (to check for May-Thurner)
- Any suggestion that there may be a proximal venous obstruction

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 reflux and/or scarring
- History of DVT
- Absence of any other lower limb venous disease

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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 vascular scientist 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 assessment policies – Please see 'Personal Protective Equipment (PPE) for infection prevention and control' policy, 'Hand Hygiene' policy and 'Staff Risk Assessments' which

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are all available through the Trust Intranet.

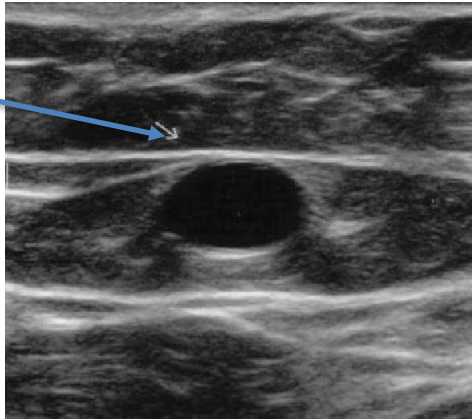
Tristel wipes are for cleaning the ultrasound machines and probes after patient use. Universal Clinell wipes are for cleaning all other equipment. Where high risk infection presents or post-op wounds are present use probe covers with sterile gel or Tegaderm dressings, in addition to routine cleaning.

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Lower limb venous ultrasound procedure

	Preceding document: <i>VAS-MP-6 Patient management</i>
1.	<p>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, externally rotate the knee and slightly raise the heel of the leg to be investigated. The heel should be 1cm above the horizontal. 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>
2.	<p>Scanning the deep veins in thigh:</p> <p>Ideally, the patient should be standing and facing forwards. 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 Common Femoral Vein (CFV). Move marginally distally and identify the Sapheno-femoral Junction (SFJ), achieving the characteristic 'Mickey Mouse' image. Compress the CFV and the length of the SFV veins with the probe and confirm patency.</p> <p>Turn the probe through 90°. Optimise your image in B mode, identifying key anatomical structures where evident (CFV, Superficial Femoral Vein (SFV), Long Saphenous Vein (LSV), Anterior Thigh Vein (ATV) and epigastric vein). Turn colour Doppler back on and observe phasic and spontaneous flow in the veins. Augment flow in the veins by squeezing the calf or lower thigh of the patient. 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. Document with additional drawing on the template any bifid veins.</p>
3.	<p>Scanning the LSV:</p> <p>Ideally, the patient should be standing and facing forwards. Turn on colour Doppler and scan the LSV, with the probe at an angle to the vein, by slowly moving the probe distally. Scan down from the sapheno-femoral junction (SFJ) down to the medial malleolus. Regularly augment the vein to confirm competency. If the LSV is incompetent, measure and document (in mm) the maximum external diameter LSV 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>

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	<p>Document any incompetent tributaries and follow the incompetence to its termination (e.g. peters out, re-joins the LSV or a draining perforator). Measure and document the size of any major dilatations. Measure the diameter and document any incompetent perforating veins at the point of piercing the deep fascia.</p> <p>Document any aberrant anatomy – most commonly, the LSV rises superficial to the fascia and can remain straight. Document if /where it re-enters the fascial plane.</p> <div data-bbox="280 613 579 925" data-label="Text"> <p>This arrow indicates the fascial plane, if the LSV sits above this line, then it is sitting outside of the fascial plane</p> </div>  <p><i>Image taken from Semantic Scholar 2020.</i></p>
4.	<p>Scanning the ATV:</p> <p>Ideally, the patient should be standing and facing forwards. Where evident, scan the vein in both transverse and longitudinal views. Observe and document as with the LSV. If incompetent, document its length within the fascial plane.</p>
5.	<p>Scanning the Short Saphenous Vein (SSV):</p> <p>Ideally, the patient should be standing and facing away from the vascular scientist. Scan the vein in transverse and follow the vein up to and including its insertion with the popliteal vein, if evident. Document key features (competency, patency, presence or absence of SPJ) as before.</p> <p>Scan the SSV throughout its entire length. Scan the SSV in both longitudinal and transverse views with colour Doppler on. Document key features as for the LSV.</p> <p>Identify the presence of the Giacomini vein and scan its entirety if deemed clinically appropriate.</p>
6.	<p>Scanning the deep veins of the calf, if indicated:</p> <p>Ideally, the patient should be standing and facing away from the vascular scientist. Scan the popliteal, gastrocnemius and soleal veins in transverse view. Optimise the B-mode. Compress the veins with the probe to confirm patency. Turn on the colour Doppler and retrace the veins in transverse and longitudinal views. Document findings on report.</p> <p>Ideally, the patient should be standing and facing forwards. Place the probe in the transverse view on the medial aspect of the calf. Optimise the B mode image. Identify</p>

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	the paired posterior tibial veins and deeper paired peroneal veins, with accompanying arteries. Turn on colour Doppler. Scan the full length of the veins in both transverse and longitudinal views. Compress the veins to confirm patency. Document findings on report.
7.	<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 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> <p>Document all findings on the report.</p>
8.	<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>
	Subsequent documents: <i>VAS-MP-6 Patient management, VAS-MP-1 Results processing</i>

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].

All diameter measurements to be documented in millimetres.

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

At SMH where reports are also written, the drawing should still contain all information as stated above.

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

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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.	Semantic Scholar. 2020. Available at: https://www.semanticscholar.org/paper/Lower-extremity-venous-anatomy.-Meissner/976c8cfabf8b94f5650398df4ef8ef8bc2343868/figure/2 Accessed: 04/11/2020.