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All Sites	VAS-DP-2	Kelly Swagell	
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Lower limb DVT ultrasound		Feb 2022	1.3

Scope & purpose

Duplex ultrasound examination is used to assess the deep and superficial venous system of the lower limb to determine the presence or absence of thrombus.

Common indications for performance of this examination include:

- Swelling
- Pain
- Tenderness
- Source of pulmonary embolism (PE)

Personnel

Clinical vascular scientists (CVS), including trainees.

Principles / performance characteristics

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

Service users & background

Patients at St Mary's Hospital, with a Wells score of 2 or more (table 1), or a positive D-dimer, may be referred to our services from Same Day Emergency Care (SDEC), the Emergency Department or from doctors within the hospital. At Charing Cross Hospital, the referral must come from a vascular outpatient surgical referral. This diagnostic investigation aims to establish if deep or superficial vein thrombus is a possible cause for their symptoms. All patients referred for a lower limb DVT scan will have a groin to ankle assessment of their deep veins following SVT guidance. However, if clinically indicated the IVC and iliac veins will also need to be imaged to exclude thrombus. 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
- Any suggestion that there may be a proximal venous obstruction

There are few contraindications for lower limb venous duplex ultrasound for the assessment of DVT; 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 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

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- Patient discomfort

Table 1 - Two level DVT Wells score, taken from NICE guidelines (ref 1)

Clinical Feature	Points
Active cancer (treatment ongoing, within 6 months, or palliative)	1
Paralysis, paresis or recent plaster immobilisation of the lower extremities	1
Recently bedridden for 3 days or more or major surgery within 12 weeks requiring general or regional anaesthesia	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than asymptomatic side	1
Pitting oedema confined to the symptomatic leg	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternative diagnosis is at least as likely as DVT	-2
Clinical probability score	
DVT likely	2 point or more
DVT unlikely	1 point or less

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.

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 DVT scans checked until they are signed off

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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 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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DVT procedure (ref 2)

	Preceding document VAS-MP-6 Patient management
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>The examination may be unilateral or bilateral dependent upon clinical symptoms.</p> <p>Ask the patient to remove their clothing to expose the lower limb from groin to ankle.</p> <p>Where possible, venous duplex scans are performed with the patient either on a tilt table or sitting up, with the CVS seated to the side or immediately in front of the patient respectively. In all cases, the most physiological assessment of the lower limb venous system is with the limb dependent.</p>
3.	<p>Scanning the lower limb deep veins.</p> <p>Place the probe over the inguinal triangle. Optimise your image in B mode, if required, and switch on colour mode. Identify key anatomical structures for example the Common Femoral Artery (CFA) and Common Femoral Vein (CFV) in transverse.</p> <p>Turn the probe through 90°. Optimise your image in B mode and colour Doppler, if required. Assess the CFV for phasic and spontaneous flow using colour and/or spectral Doppler, also checking for any flow voids and assessing for the presence of echoes in B-mode. To further demonstrate phasicity in the CFV, place the spectral Doppler in the vein and ask the patient to take a deep breath in and out, perform a Valsalva manoeuvre or to cough.</p> <p>In B-mode start compression of the CFV in the groin with the probe and confirm patency (complete compression of the vein is necessary to exclude thrombus). Continue to examine the lower limb veins distally, examining the length of the FV, the proximal DFV, the PV (ensuring the whole length is visualised including the adductor region), the posterior tibial veins, peroneal veins, gastrocnemius veins and soleal</p>

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	<p>veins. Colour Doppler may also be used in conjunction with B-mode.</p> <p>Also compress the great saphenous and small saphenous veins for any evidence of superficial thrombophlebitis (STP).</p> <p>Although not routinely imaged the anterior tibial veins may be assessed if pain is localised to this region.</p> <p>If the patient is unable to tolerate compression or compression cannot be performed, the veins can be assessed in longitudinal plane with colour flow, using augmentation distal to the probe to assess patency of the veins. If compression of the veins cannot be carried out this should be documented on the report.</p> <p>The machine controls should be optimised in a diagnostically appropriate way throughout the scan.</p>
4.	<p>If thrombus is identified, the extent of the thrombus should be quantified making reference to the anatomical position and drawn representatively on the report. It should also be determined whether it is occlusive and/or non-occlusive. If felt appropriate, B-mode can be used to estimate the age of the thrombus (acute vs chronic). The thrombus can also be described by its echogenicity.</p> <p>If superficial vein thrombus (thrombophlebitis) is identified, check if the thrombus is close to the deep system (SFJ/SPJ/perforators). Give a distance in length if necessary.</p> <p>Document any incidental findings e.g. Baker's cyst, venous insufficiency, fluid collection.</p>
5.	<p>Scanning the IVC and iliac veins.</p> <p>Assessment of the iliac veins should be included when there is suspicion of proximal obstruction as indicated by the referring clinician, the clinical history, or when during the investigation flow in the CFV does not exhibit spontaneous phasic flow with respiration (as seen using pulsed wave Doppler signal). If imaging of the IVC and iliac veins is clinically indicated then the following protocol is used.</p> <p>It may be unilateral or bilateral depending on the clinical indication. The patient should be in the supine position. Using the C5-1 probe or L12-3 (where appropriate), turn on colour Doppler and examine IVC, Common Iliac Vein (CIV), Internal Iliac Vein (IIV) and External Iliac Vein.</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 DVT 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.

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The report should include:

- The presence/absence of phasic flow in the proximal veins.
- Which veins have been assessed & record the presence/absence of thrombus. Any veins not imaged must be clearly documented on the diagram.
- Where thrombus is identified; the location, extent & degree of patency (occlusive or non-occlusive). If felt appropriate, the appearance of the thrombus (i.e. acute, chronic, echolucent, echogenic – as deemed appropriate) can be commented on.
- Any limitations encountered during the examination.
- Any incidental findings.

If the scan is positive for a DVT and the patient is an outpatient and not being seen by the referring team that day then the patient should remain in the department until the referring team are contacted and informed of the results.

If the scan is positive for a DVT and the patient is an inpatient then the referring doctor should be informed.

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

References

1.	VAS-ED-18. NICE guidelines: Management of Deep vein thrombosis (2020).
2.	VAS-ED-4. Vascular Technology Professional Performance Guidelines Upper and Lower Limb Venous Duplex Ultrasound Examination: DVT (2021).