

## Document Control Page

|                                |   |
|--------------------------------|---|
| <b>Title:</b>                  | Deep Vein Thrombosis  |
| <b>Version:</b>                | 4   |
| <b>Supersedes:</b>             | Version: 3.1<br>Reference Number: DVT003                                |
| <b>Application:</b>            |   |
| <b>Originated/modified by:</b> | Helena Edlin, Lead Vascular Scientist<br>Ming Yeung, Vascular Scientist |
| <b>Ratified by:</b>            | H.Edlin   |
| <b>Date of ratification:</b>   | 13/12/2022  |

|  |            |
|--|------------|
| <b>Issue / circulation date:</b>         | 19/12/2022 |
| <b>Circulated by:</b>                    | M. Yeung   |
| <b>Dissemination and implementation:</b> |            |
| <b>Date placed on the intranet:</b>      |            |

| Consultation/acknowledgement with stakeholders |             |                        |
|--|-------------|------------------------|
| Name   | Designation | Date response received |
|  |             |                        |
|  |             |                        |
| <b>Planned review date:</b>                    |             |                        |
| <b>Responsibility of:</b>                      |             |                        |

|   |  |
|---|--|
| <b>Minor amendment (if applicable) notified to:</b> |  |
| <b>Date notified:</b>                               |  |

|   |  |
|---|--|
| <b>Minor amendment (if applicable) notified to:</b> |  |
| <b>Date notified:</b>                               |  |

| Review history  |         |          |   |
|---|---------|----------|---|
| This must be completed and form part of the document appendices each time the document is updated and approved. |         |          |   |
| Date<br>DD/MM/YY  | Version | Author   | Reason for changes  |
| 05/12/2022  | 4       | M. Yeung | New format, removed hospital acquired incident form, mark report critical on hive |
|   |         |          |   |

|  |  |
|--|--|
| <b>Exam Name:</b>                              | <b>Deep Vein Thrombosis</b>  |
| <b>Valid Indications:</b>                      | <b>Justification:</b><br>Deep vein thrombosis (DVT) can be fatal if thrombus embolises to the lungs and frequently causes damage to the valves in the deep veins resulting in long term problems. Duplex scanning for the detection of DVT is the primary investigation of choice in many centres. |
| <b>Vetting:</b>                                | <b>Clinical Vascular Scientist:</b><br>Vet / authorize requests prior to examination, see referral guideline doc re priority   |
| <b>Contraindications and comments:</b>         | <b>Contraindications:</b>  |
| <b>Appointment time:</b>                       |  |
| <b>CRIS code:</b>                              |  |
| <b>Patient preparation before appointment:</b> |  |
| <b>Room prep:</b>                              | <b>PPE available:</b> non-sterile gloves, plastic aprons.<br><br>Equip: Service and quality control test are carried out by supplier/medical physics – Christie and in house.  |
| <b>Staffing Roles and responsibilities</b>     | <b>Authorised to perform:</b><br>Qualified Clinical Vascular Scientist with training.<br>Trainee under supervision of qualified member of staff.   |
| <b>Staffing levels:</b>                        | 1 member of staff required to perform the scan<br>An assistant may be required for complex patients with mobility issues.  |

|                                     |  |
|-------------------------------------|--|
|                                     | <i>Staff must ensure they have been appropriately trained to perform the scan and on the equipment which is being use.</i>   |
| <b>Consumables:</b>                 | <p>Ultrasound gel<br/>Tissue paper<br/>Paper roll for the couch</p>  |
| <b>Patient prep at appointment:</b> | <p>Patient needs to be asked to remove clothing from area being scanned.</p> <p>Consideration should be given to privacy and dignity as well as religious beliefs when asking patients to prepare for this examination and seeking approval for those present in the room during the examination itself</p>  |
| <b>Standard protocol:</b>           | <p>Patient can sit along the couch with the backrest of the couch tilted or patient can be assessed in a standing position, both aiding venous pooling. The leg should be externally rotated and the knee slightly flexed.</p> <p>Use high frequency linear array transducer with venous default setting selected on the Duplex machine to optimise the image to identify low velocity blood flow.</p> <p>The transducer is placed in the groin and the common femoral vein (CFV) is identified medial to the common femoral artery in a longitudinal plane. On thigh/calf augmentation, all veins should fill from wall to wall with uniform colour filling. If the vein does not fill wall to wall, thrombus may be present, but different steering angles and lower colour flow velocity profiles should be used to optimise colour filling.</p> <p>In longitudinal section, assess the CFV using spectral Doppler where the patient should be asked to take a deep breath. Normal flow in the CFV is phasic with respiration and non-pulsatile. If continuous non-phasic flow is present, a proximal obstruction or occlusion should be suspected, the ipsilateral iliac vein and/or the IVC should be examined if possible. If this isn't conclusive, scan the contralateral CFV to assess phasicity and compare to symptomatic side.</p> <p>Moving distally along the CFV, the proximal profunda femoris vein (DFV) and the length of the superficial femoral vein (SFV) are assessed for patency using colour flow. Augmenting the calf will also highlight any areas of non occlusive thrombus which may otherwise be missed (this shows as turbulent flow on the Colour Doppler).</p> |

After completing the assessment of the femoral veins with colour flow and Doppler, move the probe back to the CFV now using B mode only.  
View the CFV in transverse plane and apply pressure using the probe to compress the vein. This is repeated at regular intervals (2-3cm) along the length of the CFV and SFV.  
Failure to fully compress the veins indicates the possible presence of thrombus and should be investigated further with colour Doppler.

The echogenicity of the thrombus indicates its age, with fresh thrombus appearing as similar echogenicity to that of blood, and old thrombus appears as a similar echogenicity to the surrounding muscle tissue.

The patient should be repositioned to scan the popliteal vein and the knee is flexed to 45°, alternatively the patient can be sat on the side of the couch with foot placed on a stool.

The transducer is placed into the popliteal fossa and the popliteal vein is identified in longitudinal plane using colour Doppler. Assess the patency and competency of the popliteal vein throughout its length until the confluence of the anterior tibial veins are reached. In B-mode, rotate the transducer so the popliteal vein is visualised in transverse plane and assess for compressibility.  
Assess patency of gastrocnemius veins using colour duplex and compression.

The patient is re-positioned with their leg externally rotated and the knee slightly flexed, alternatively, remain seated on the side of the couch with foot on a stool.

The anterior tibial veins may be seen as the first deep communication with the popliteal vein. Distal to this junction the tibio-peroneal trunk veins divide to form the posterior tibial and peroneal veins. It is easiest to trace the deep calf veins from the ankle proximally. Placing the transducer posterior to the medial malleolus the posterior tibial artery and two veins can be visualised in a longitudinal plane. All calf veins can be augmented by squeezing the foot. The posterior tibial veins should be traced proximally ensuring both are viewed along their length in longitudinal and transverse planes with no evidence of deep vein thrombosis (full colour filling and compressibility).  
The probe is angled slightly posteriorly and the peroneal artery and veins should be visualised deep to the posterior tibial vessels. They are traced proximally ensuring both are viewed along their length in longitudinal and transverse planes with no evidence of deep vein thrombosis.

The anterior tibial veins, long saphenous and short saphenous veins are not routinely scanned, however, if symptoms are localized to these areas, these veins should be scanned.

If required:

Place the transducer on the anterior aspect of the ankle, the anterior tibial artery and veins can be visualised and traced to the proximal calf ensuring that both are viewed along their length in longitudinal and transverse planes with no evidence of deep vein thrombosis.

Always scan over painful swollen area looking for any other pathology eg haematoma, thrombophlebitis, Bakers cyst etc. If thrombophlebitis is present the location and length of the clot should be recorded and reported. Anticoagulation may be considered; European guidelines suggest anticoagulation should be considered if the clot is >5cm in length or within 3-5cm away from the SFJ (3). If alternative pathology is noted then this should be reported as a description only, suggesting referral to musculo-skeletal ultrasound i.e. cystic structure present in popliteal fossa – referral for MSK ultrasound if required.

If spectral Doppler is used to assess incompetency, the Doppler beam is steered to a 60° Doppler angle, and the sample volume size is increased across the full diameter of the lumen.

Augmentation of the thigh/calf will result in venous return and a negative deflection on the spectral analyser. On release of the thigh/calf, reflux will be seen as a positive deflection of >0.5 seconds and the vein is reported to be incompetent. If the positive deflection is <0.5 seconds, the vein is competent.

### Results

Normal:

- vein compressibility
- spontaneous, phasic venous Doppler signal with respiration
- complete colour filling of the lumen
- good flow on augmentation
- competency of the deep veins

Abnormal:

- Acute –  
Incompressible vein  
Partial or complete loss of colour in lumen

|  |   |
|--|---|
|  | <p>Vein appears dilated<br/>Non-homogenous/echolucent area</p> <ul style="list-style-type: none"> <li>Chronic -<br/>Vein not visualised or shrunk<br/>Large collateralisation present<br/>Organised thrombus, characterised as a homogenous echogenic area<br/>Superficial veins dilated<br/>Incompetence present due to damaged valves</li> </ul> <p><u>Suggested images:</u></p> <ul style="list-style-type: none"> <li>Common femoral vein showing phasic response (LS)</li> <li>Profunda vein colour filling (LS)</li> <li>Femoral vein proximal, mid and distal – colour filling (LS) and b-mode compression</li> <li>Popliteal vein proximal and distal – colour filling (LS) and b mode compression</li> <li>Calf veins if pathology reported</li> </ul>   |
| <p><b>Troubleshooting/<br/>Pitfalls:</b></p> | <ul style="list-style-type: none"> <li>Suboptimal visualisation - due to tense swollen painful limb rendering compression of vein and sometimes augmentation of veins intolerable, overlying oedema, and excessive arterial calcification causing acoustic shadowing affecting visualisation of underlying vein.</li> <li>Anomalies such as venous duplication.</li> <li>Mistaken identity of veins - can be prevented by locating and documenting major anatomic landmarks that confirm the identity of veins.</li> <li>Bakers cyst- symptoms of Bakers cyst may mimic those of a DVT, but this can be accurately diagnosed. It appears as an echolucent mass in the popliteal fossa, is not vascular in nature but may compress onto the popliteal vein.</li> <li>Compression difficulties - a vein may resist compression and yet contain no thrombus due to the depth of the vessel, the angle of the course of the vessel, and overlying tendons and muscles (e.g. iliac vein, profunda femoris vein and distal superficial femoral vein as it dives through the adductor canal).</li> </ul> |

|                                      |   |
|--------------------------------------|---|
| <b>Patient Discharge</b>             | <p>Inform the patient who will inform them of their results.<br/>If a positive DVT is identified, mark report as 'critical' and communicate results to referring Dr by phone.</p>   |
| <b>Reporting</b>                     | <p>The report should refer to the superficial femoral vein as the femoral vein as per national venous forum guidance 2018.</p> <p>Report:<br/>The presence/absence of phasic flow in the proximal veins<br/>Which veins have been assessed &amp; record the presence/absence of thrombus<br/>Where thrombus is identified, the location, length/extent, degree of patency and whether the thrombus is acute or chronic should be documented (the length and location of any clot in the superficial veins should also be noted)<br/>Any limitations encountered during the examination<br/>An appropriate number of annotated images that represent the entire ultrasound examination - in accordance with local protocols and SVT Image Storage Guidelines</p> |
| <b>Patient and staff safety</b>      | <p>Use output powers quoted by the manufacturer and in accordance to ALARA / AIUM criteria.<br/>Infection control: see latest Vascular Lab Infection control and working practices policy.<br/>Couch and chair should be adjusted to optimum height to avoid work related upper limb disorder.</p>  |
| <b>References &amp; Bibliography</b> | <p>Society for Vascular Technology Professional Standards Committee Image Storage Guideline April 2012</p> <p>NICE - Thrombophlebitis – superficial. Last revised in July 2015</p> <p>Scott, G., Mahdi, A. J. and Alikhan, R. (2015), Superficial vein thrombosis: a current approach to management. Br J Haematol, 168: 639–645. doi:10.1111/bjh.13255</p> <p>Coleridge-Smith, P, Labropoulos, N, Partsch H, Myers K, Nicolaidis A, Cavezzi A. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs –UIP Consensus Document. Part 1 Basic principles. Eur J Vasc Endovasc Surg 2006; 31:83-92</p>   |