THE SOCIETY FOR VASCULAR TECHNOLOGY OF GREAT BRITAIN AND IRELAND

PHYSIOLOGICAL MEASUREMENT SERVICE SPECIFICATIONS

Vascular Technology

Assessment for Deep Vein Thrombosis (DVT)

This investigation uses ultrasound to image and assess flow and to detect thrombus in the deep veins usually of the legs, but sometimes the arms. An ultrasound probe is used to scan the limb to assess flow and to detect the presence of thrombus. The superficial veins are also investigated to determine whether there is any thrombus close to the junction with the deep veins.
Patients who have suspected DVT, superficial thrombophlebitis or pulmonary embolism (PE) are likely to require this test. DVT is a common disorder that can lead to a fatal PE. Patients with a suspected DVT usually present with a painful, swollen and tender limb. Particular risk factors for developing a DVT are malignancy and immobility. Patients who have had recent surgery or who have thrombophilia are also at higher risk.

1. PATIENT PATHWAY

Duplex ultrasound assessment is the major diagnostic test in confirming the presence of acute DVT. To ensure best use of resources, the pathway often includes simple screening tests such as Wells scoring and D-dimer pathology testing before proceeding to a Duplex investigation[1].
These screening tests have high negative predictive values, but low positive predictive values. If these tests are positive a Duplex scan should be carried out[2,3]

2. REFERRAL

Clinical Indications

The main indication for this investigation is suspicion of DVT. It is important to note that it is difficult to diagnose a DVT by clinical symptoms alone and that other conditions such as cellulitis and lymphoedema can give similar symptoms[3].
Clinical features for legs include sudden swelling of one leg, acute pain and calf tenderness with moderately raised temperature. Similar features are experienced in the arm.
Patients with a suspected recurrent DVT are also likely to require this test. It may be required to investigate the source for PE. It may also be used for patients with thrombophlebitis.

The major risk factors for DVT include recent surgery or trauma, immobility (including air travel), coagulation disorders, malignancy, pregnancy, oral contraceptives and hormone replacement therapy.
Further information is given in the Society for Vascular Ultrasound professional guidelines for lower limb DVT and upper extremity venous duplex[4,5]
Serial or repeat scanning to investigate propagation of DVT and/or recannalisation of veins may also be requested.

Contra indications
The scan may be limited in the case of high body mass index (BMI), a very painful or swollen/oedematous limb or where access is limited; for example by a wound/ulcer or by a cast that cannot be removed.

3. EQUIPMENT

Specification
A high resolution imaging ultrasound duplex scanner which has colour, power and pulsed Doppler modalities is required. A midrange (covering nominal frequencies of 4-9MHz) linear array transducer (probe) should be used. A lower frequency (covering nominal frequencies of 2.5-4MHz) curved array transducer should be available, which will enable abdominal veins to be assessed if required or can be used to give better penetration if the thigh or calf is very large.
There should be facilities to record images/measurements[6]. The Royal College of Radiologists (RCR) has more detailed technical standards for ultrasound equipment[7].
It should be noted that a range of relatively low cost portable scanners is now available, not all of which will be suitable for vascular work.
It is important that the duplex scanner is of ergonomic design as explained in the health and safety section to minimise the risk of operator work related musculoskeletal disorders[8].

Maintenance
Equipment should be regularly safety-tested and regularly maintained in accordance with the manufacturer's recommendations. Further information is available from the British Medical Ultrasound Society (BMUS): 'Extending the provision of ultrasound services in the UK'[9].

Quality Assurance (QA) and Calibration
QA procedures should be in place to ensure a consistent and acceptable level of performance of all modalities of the duplex scanner. Such procedures are likely to be set up with involvement from Medical Physics Departments or service engineers as they require specialist skills and will may require both imaging and phantoms.
Detailed guidance on the QA of the imaging modality of duplex scanning is contained in the Institute of Physics and Engineering in Medicine (IPEM) Quality Assurance of Ultrasound Imaging Systems report 102[10]. The IPEM report 70 Testing of Doppler Ultrasound Equipment, contains extensive information relating to performance testing of the pulsed and colour Doppler modalities of duplex scanners[11].
Further general guidance is available in 'Guidelines for
Professional working standards: Ultrasound practice'[12].

Set up procedures
An appropriate probe should be selected. All duplex control settings should be set to defaults appropriate for a venous investigation. Equipment manufacturer will normally provide appropriate default venous settings.

Infection control
There are no nationally agreed standards for vascular ultrasound scanning but local infection control policies should be in place. BMUS [9] advises that users should refer to manufacturer's instructions for the cleaning and disinfection of probes and transducers and general care of equipment. It should be noted that ultrasound probes can be damaged by some cleaning agents and so manufacturer's specifications should always be followed. Sterile ultrasound gel and sheaths should be available and used in appropriate cases. Particular care should be taken around ulcers.

Accessory equipment:
Examination couches and scanning stools must be of an appropriate safety standard and ergonomic design to prevent injury, particular consideration should be given to reducing the risk of operator work related musculoskeletal disorders [8] .

4. PATIENT

Information and consent
There is no legal requirement that written patient consent be obtained prior to a venous duplex examination. However, patients should be fully informed about the nature and conduct of the examination so that they can give verbal consent. It is desirable that this information is provided in written format and is given prior to their attendance [13]. This information should also be verbally explained to the patient when they attend for the investigation. Examples of additional patient information to include can be found at the RCR http://www.rcr.ac.uk/docs/patients/worddocs/CRPLG_US.doc
The Circulation Foundation produces leaflets which provide further information to patients: www.circulationfoundation.org.uk.

Clinical history
The referral for the investigation should contain relevant clinical history. This information should be verified and clarified for any discrepancies

The nature and duration of symptoms should be established. Any history of lower extremity venous insufficiency, previous DVT and/or superficial vein thrombosis, extremity trauma, venous ulcers and/or varicosities should be noted [4,5] .

Preparation
No specific preparation is required[67]. Access will be required to the patient's leg or arm.
Compression stockings should be removed. Where appropriate any other dressings should be removed. This test involves using the probe to apply pressure on the limb to compress the vein, and also squeezing the limb below the level of the probe. Careful explanation of this will aid compliance as pain is often felt at the site of thrombosis and compression can be uncomfortable or painful for the patient.

5. ENVIRONMENT

The environment in which ultrasound scanners are used can have a profound effect on the efficiency of the service. A private room is preferable to carry out the scan, although it may be possible to use a curtained off area in a larger multi-scan bay unit, if provision is made to ensure privacy for each patient. On occasion, scans may need to be carried out in other

localities e.g. in theatre, theatre recovery or at the patient's bedside. These scans may be limited due to poor environmental conditions, are time-inefficient and pose additional ergonomic risks for the operator and should be minimised where possible.

The room lighting needs to be dimmable to ensure reflections do not interfere with the operator's view of the screen and air-conditioning is recommended to prevent excessive temperatures, seeking advice from the ultrasound manufacturer regarding exact requirements. Sufficient electrical power sockets are needed to support the demands of the scanner, couch, IT equipment and any accessories, the socket positions should be carefully planned to prevent trailing leads. Image storage and reporting on PACS or a similar system is recommended, IT provision should be compatible with efficient use of such systems, for example, dual monitors on computer workstations.

All equipment should be purchased with consideration for control of infection requirements, and should be easily cleaned and disinfected. Facilities for timely replacement, regular servicing, maintenance and safety checking should be in place.
The ability to minimise ergonomic risks should also inform ultrasound scanner, couch and seat/stool purchasing decisions. The maximum weight of the couch should be clearly displayed.
Further general guidance on the environment is given in the BMUS document "Extending the provision of ultrasound services in the UK"[9] and United Kingdom Association of Sonographers "Guidelines for Professional Ultrasound Practice"[12] and the Royal College of Radiologists document "Standards for the provision of an ultrasound service"[7]

6. PROCEDURE, INTERPRETATION and REPORT

For detailed information on PROCEEDURE, INTERPRETATION and REPORT please refer to DVT Ultrasound Professional Performance guideline https://www.svtgbi.org.uk/professional-issues/

7. WORKFORCE

It is well recognised that ultrasound diagnosis is highly operator-dependent; it is essential the workforce has the appropriate knowledge and competence. This is achieved by ensuring the workforce has followed recognised education and training routes. This applies to both medically and non-medically qualified individuals.

Education and training requirements

All staff performing and reporting investigations should have successfully completed one of the following education and training routes:

(i) Full SVT accreditation (Accredited Vascular Scientist)
http://www.svtgbi.org.uk/education

(ii) Post graduate qualification in ultrasound imaging from a Consortium for Accreditation of Sonographic Education (CASE) accredited course, with successful completion of a vascular module that included clinical competence in venous duplex scanning. A list of CASE accredited courses can be found at http://www.case-uk.org/

(iii) Medical staff should have successfully followed the RCR recommendations for training in vascular scanning to level 2 competence in peripheral extremity veins BFCR(17)3 https://www.rcr.ac.uk/publication/ultrasound-training-recommendations-medical-and-surgical-specialties-third-edition

(iv) Completion of the NHS Scientist Training Programme specialising in Vascular Science and statutory registration as a Clinical Scientist with the Health and Care Professions Council (HCPC.) http://www.nshcs.hee.nhs.uk/join-programme/nhs-scientist-training-programme

It is recommended that staff perform local competencies and are involved in audit (both results and peer audit https://www.bmus.org/static/uploads/resources/Peer_Review_Audit_Tool_wFYQwtA.pdf) to maintain high standards.

Regulation

It is important both staff and employers are aware that although ultrasonography is not currently a regulated profession, there is a move towards future statutory regulation of all healthcare science groups. Current statutory or voluntary registration includes:

(i) Registered on the SVT Voluntary Register
(ii) UK Registered Physicians on the General Medical Council (GMC) Specialist Register http://www.gmc-uk.org/doctors/register/LRMP.asp
(iii) Registered Clinical Scientist with Health and Care Professions Council (HCPC) http://www.hpc-uk.org/check/
(iv) Registered on the Public Voluntary Register of Sonographers held by the Society and College of Radiographers (SCoR.) https://www.sor.org/practice/ultrasound/register-sonographers

Maintaining competence

It is important scanning competence is maintained by all personnel performing these investigations, either by performing a minimum number of scans per year, or through a CPD scheme. Criteria for ensuring continuing competence are set by professional bodies.

Continuing Professional Development (CPD)

Staff must undertake CPD to keep abreast of current techniques and developments, and to renew or extend their skills.

I. SVT accredited sonographers must maintain their accreditation by meeting the CPD requirements of the SVT: https://www.svtgbi.org.uk/education/maintaining-avs-registration/

II. Staff with a post graduate qualification in ultrasound imaging should meet the CPD requirements for SCoR registration: http://www.sor.org/learning/document-library/continuing-professional-development-professional-and-regulatory-requirements

III. Medical staff should follow the requirements required for maintaining their skills, as well as the need to include ultrasound in their ongoing CME: https://www.rcr.ac.uk/clinical-radiology/cpd-scheme

IV. Clinical Scientists maintain registration with CPD through the HCPC. http://www.hpc-uk.org/registrants/cpd/standards/

8. AUDIT, SAFETY & QA

Safety

The provider should be aware of the guidelines for the safe use of ultrasound equipment produced by the Safety Group of BMUS [14]. In particular, they should be aware of ultrasound safety precautions related to vascular scanning. All staff should be aware of local safety rules and resuscitation procedures.

Sonographers are at risk of work related musculoskeletal disorders. To minimise this risk the scanner and its control panel, the examination couch and scanning stool must be of appropriate safety standard and ergonomic design.

The published document by the Society of Radiographers (SCoR) 'Prevention of Work Related Musculoskeletal Disorders in Sonography' [8] gives clear guidance on this issue as well as 'Guidelines for Professional Working Standards Ultrasound Practice' [12]

QA and Audit

There are no specific requirements, but a mechanism of audit/quality control to ensure patients continue to receive high level of diagnostic accuracy should be in place.

QA and audit programs should cover:

- Equipment performance
- Patient service
- Quality of investigation

The BMUS document [9] and UKAS Guidelines[12] also give guidance. Equipment QA is covered in section 3 of this document.

Websites:

www.rcr.ac.uk
www.bmus.org
www.svtgbi.org.uk
www.svunet.org
www.case-uk.org
www.ipem.ac.uk
www.hpc-uk.org
www.rcplondon.ac.uk
www.vascularsociety.org.uk
www.circulationfoundation.org.uk
www.sor.org
www.nice.org.uk

References

[1] NICE Guideline: Venous thromboembolic diseases: the management of venous thromboembolic diseases and the role of thrombophilia testing http://www.nice.org.uk/guidance/CG144

[2] American College for Emergency Physicians. Clinical policy: critical issues in the evaluation and management of adult patients presenting with suspected lower-extremity deep venous thrombosis. Ann Emerg Med 2003; 42: 124-35.

[3] Measurement of the clinical and cost-effectiveness of non-invasive diagnostic testing strategies for deep vein thrombosis. S Goodacre, F Sampson, M Stevenson, A Wailoo, A Sutton, S Thomas, T Locker and A Ryan. Health Technology Assessment 2006; Vol. 10: No.15

[4] SVT PPG Lower Limb Venous Duplex Ultrasound Examination for the Assessment of Deep Vein Thrombosis (DVT) https://www.svtgbi.org.uk/professional-issues/

[5] SVT PPG Upper Limb Venous Duplex https://www.svtgbi.org.uk/professional-issues/

[6] SVT Guidance on Image Storage and use, for the vascular ultrasound scans 2012 https://www.svtgbi.org.uk/professional-issues/

[7] Standards for the Provision of an Ultrasound Service Royal College of Radiologists 2005 www.rcr.ac.uk/docs/radiology/pdf/StandardsforUltrasoundEquipmentJan2005.pdf

[8] 'Prevention of Work Related Musculoskeletal Disorders in Sonography - Society of Radiographers 2014 https://www.sor.org/sites/default/files/document-versions/sor_industrystandards_prevention_musculoskeletal.pdf

[9] Extending the provision of ultrasound services in the UK' BMUS 2003 http://www.bmus.org/policies-guides/pg-protocol01.asp

[10] Quality Assurance of Ultrasound Imaging Systems' IPEM report 102 2010

[11] Testing of Doppler Ultrasound Equipment' IPEM report 70 1994