THE SOCIETY FOR
VASCULAR TECHNOLOGY OF
GREAT BRITAIN AND IRELAND

Vascular Technology Professional Performance Guidelines

Lower Limb Arterial Duplex Ultrasound Examination

This guideline was prepared by the Professional Standards Committee (PSC) of the Society for Vascular Technology (SVT) as a template to aid the clinical vascular scientist/vascular sonographer and other interested parties. This guideline maybe used in part or in its entirety with suitable additions made by local policy implementers.
Suggestions for improvement of this guideline are welcome and should be sent to the Chair of the PSC – see www.svtgbi.org.uk for current Chair details.

Purpose
Duplex ultrasound examination is used to assess the arteries of the lower limb (aorta to ankle level) to determine the location and severity of vascular disease (occlusive and aneurysmal).

Common Indications
Common indications for the performance of this examination include:

- Intermittent claudication
- Ischemic rest pain
- Gangrene
- Ulceration
- Post-surgical intervention follow-up e.g. angioplasty
- ?aneurysm
- ?false aneurysm

Contraindications and Limitations
Contraindications for lower limb arterial duplex ultrasound assessment are unlikely; however, some limitations exist and may include the following:

- Obesity
- Casts, dressings, open wounds etc.
- Bowel gas when examining the aorto-iliac segment
- Patients who are unable to cooperate due to reduced cognitive functions e.g. Alzheimer's or dementia and through involuntary movements

Equipment:

Duplex Doppler ultrasound machine with imaging frequencies of 3.5MHz and greater; with both linear and curvilinear transducers available. Doppler frequencies of at least 3.0MHz should be available, with colour Doppler capability.
Compliance with the Medical Devices Directive is necessary. Electrical safety testing is required annually, with regular maintenance and quality assurance testing to specified level by qualified personnel. Review of in-service equipment should typically be undertaken four - six years after installation[1].
Examination couch should be height adjustable preferably electrical. The CVS's chair should provide good lumbar support, be height adjustable and allow for the CVS to move close to the examination couch[2 3].
The examination room should be temperature controlled with adjustable lighting levels suitable for examination[5].

Explanation of examination and patient history:
The CVS undertaking the examination should:

- introduce themselves
- confirm the patient's identity e.g. full name and date of birth
- explain why the examination is being performed
- give an explanation of the procedure and it's duration – consideration should be made to the age and mental status of the patient
- obtain verbal consent for the examination
- obtain a pertinent relevant medical history from the patient and/or notes
    - Presence of risk factors
        - Smoking
        - Hypercholesterolemia
        - Hypertension
        - Diabetes
    - Results of other relevant diagnostics & previous vascular studies

Examination:
The examination may be unilateral or bilateral dependent upon clinical symptoms and departmental policy. The patient is asked to remove their clothing to expose the lower limb from groin to ankle and the examination is performed with the patient supine. Their dignity and privacy should be maintained at all times and due to intimate nature of the examination it may be considered necessary to offer a chaperone[4]

During the examination the patient's mental and physical status should be monitored and modifications made to the examination accordingly.

Ankle brachial pressure index (ABPI) could be recorded as a baseline (the adjuvant of toe pressures may be advantageous).

The following appropriate techniques should be used to evaluate the lower limb arterial system:

- B-mode should be used to image the artery and assess for, aneurysmal dilation and vessel contents e.g. athermanous plaque
- Spectral Doppler should be used to determine direction of flow, stenotic flow and absence of flow

- Colour Doppler should be used to assess for the presence/absence of flow and aid the position of spectral Doppler when quantifying stenoses.

Any areas where the colour flow Doppler appears disturbed should always be interrogated with pulsed Doppler. The highest peak systolic velocity should be measured at the site of the disturbance or narrowing (Vs) and in a normal area of the artery just proximal to the narrowing (Vp). Care should be taken to ensure that the Doppler angle is 60º or less when recording velocity measurements.

The main criterion used to grade the degree of narrowing in a lower limb artery is the ratio of Vs to Vp, known as the peak systolic velocity (PSV) ratio. The PSV ratio is used to grade the severity of the narrowing. A PSV ratio of greater than 2 is generally used to define a stenosis that is causing a greater than 50% reduction in the diameter of the artery. A PSV ratio of greater than 4 is generally used to define a stenosis that is causing a greater than 75% reduction in the diameter of the artery. Changes in the shape of Doppler waveforms are important criteria in determining the presence of disease. Multiphasic waveforms are representative of normal flow, whereas monophasic/damped waveforms usually represent diseased flow.

For bypass grafts, the entire length of the graft should be scanned paying particular attention to the anastomoses. The inflow and outflow should also be assessed. Similarly, for stent insertions, particular attention should be given to imaging and assessing flow through the stent together with an assessment of the inflow and outflow to the stented area.

Evaluation of the following arteries should be included:

- Aorta
- Common iliac artery (CIA)
- External iliac artery (EIA)
- Common femoral artery (CFA)
- Proximal profunda femoris artery (PFA)
- Superficial femoral artery (SFA)
- Popliteal artery
- Tibio-peroneal trunk (TPT)
- Posterior tibial artery (PTA)
- Peroneal artery
- Anterior tibial artery (ATA)

Reporting:

The report is a recording and interpretation of observations made during the lower limb arterial duplex ultrasound examination; it should be written by the CVS undertaking the examination and viewed as an integral part of the whole examination[5].

The report should include correct patient demographics; date of examination; examination type and the name and status of the CVS.

The reporting should include:

- Which arteries have been assessed commenting on the presence/absence of flow
- The anatomical position and length of any occlusions or stenoses e.g. *x* cm in length starting *y* cm above the medial femoral condyle
- The anatomical position and size of any aneurysms
- Any limitations e.g. difficult examination due to body habitus

- An appropriate number of annotated images that represent the entire ultrasound examination - in accordance with local protocols and SVT Image Storage Guidelines[5]

Ensure appropriate efficient referral of critical ultrasound results to the referring consultant are made prior to the patient being discharged so treatment plans can be enforced or expedited accordingly.

There are no specific recommendations for the structure and content of reports for upper and lower arterial scans, but many referrers find a pictorial report with written conclusions helpful. However, any evidence of plaque formation within the vessel lumen, wall calcification or dilatation should be documented in the report together with severity and location. Comments on the shape of the Doppler waveform at different locations should be included in the report. Where the investigation was a surveillance or follow up scan of an intervention, the report should give details of the intervention and should specifically comment on the patency and flow in the region of the intervention.

The report should be signed by the operator carrying out the test. Where a computer generated reporting system is used, the verification and authorisation procedure should be followed.
The report should be made available to the referring clinician on the day of the test. Any urgent findings, should be brought to the attention of the referring clinician immediately.

RESOURCES:

Society for Vascular Ultrasound Vascular Technology Professional Performance Guidelines Lower Limb Extremity Venous Duplex Evaluation 2011 www.svunet.org

American Institute of Ultrasound in Medicine Practice Guideline for the Performance of Peripheral Venous Ultrasound Examinations 2010 www.aium.org

Australasian Society for Ultrasound in Medicine Policies and Statements D20 Peripheral Venous Ultrasound 2007 www.asum.com.au

REFERENCES:

[1] Standards for Ultrasound Equipment Royal College of Radiologists, February 2005 www.rcr.ac.uk

[2] Guidelines for Professional Working Standards Ultrasound Practice United Kingdom Association of Sonographers (UKAS) October 2008 www.sor.org/learning/document-library

[3]The Causes of Musculoskeletal Injury Amongst Sonographers in the UK Society of Radiographers, June 2002 www.sor.org/learning/document-library

[4]Society for Vascular Technology Professional Standards Committee Chaperone Guidelines April 2012 www.svtgbi.org.uk

[5] Society for Vascular Technology Professional Standards Committee Image Storage Guideline April 2012 www.svtgbi.org.uk

SVT Professional Standards Committee October 2017 – Review Date October 2020