

# Vascular department

## Lower extremity

## arterial duplex scan

## protocol

## **Arterial Duplex Scan of the Lower Extremities**

### **Purpose**

Arterial Duplex ultrasound examinations are carried out to assess for occlusive and aneurysmal disease in the major arteries of the lower and abdomen. This test is also used for surveillance following interventions such as bypass graft or stent.

### **Common Indications**

- Claudication
- Rest Pain
- Critical Limb Ischemia
- Ulceration/tissue loss/gangrene
- Surveillance following intervention
- Suspected aneurysmal disease, both native and as a result of intervention
- Pre – Renal transplant
- To exclude arterial disease where compression dressings are being considered
- Evaluation of suspected Popliteal Artery Entrapment Syndrome (PAES)

### **Contraindications/ Limitations**

- Patients with high body mass index.
- The presence of ulcers, wounds, bandaging or casts and for patients who have had recent surgery, ultrasound visualization may be limited due to oedema, haematoma, surgical staples, dressings etc.
- Calcified plaque may cause acoustic shadowing limiting Doppler and B-mode image assessment.
- Patients who are unable to lie with their limbs flat or still due to extreme pain or pre-existing co-morbidities e.g. chronic obstructive pulmonary disease (COPD) and arthritis – although these patients may be able to tolerate being examined seated with the limb dependent or with the head of the bed raised where practical.
- Patients who are unable to cooperate (mentally or physically) or those with involuntary movements
- Examinations undertaken portably at the patient's bedside may be limited due to equipment, inappropriate light levels and room dimensions.
- The presence of catheters or vascular access lines which limit visualization of the vessels.

### **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 relevant part to be examined (this may be the lower limb from groin to ankle or abdomen). 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. During the examination the patient's mental and physical status should be monitored and modifications made to the examination accordingly.

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

- B-Mode should be used to image the artery and assess for, aneurysmal dilation and vessel contents e.g. atheromatous plaque, thrombus.
- Colour Doppler should be used to assess for the presence/absence of flow and aid the position of spectral Doppler when quantifying stenosis.
- Pulsed wave Doppler should be used to determine the direction or absence of flow, and measure the velocity of flow to enable assessment of stenosis/occlusions.

Any areas where the optimised colour flow Doppler appears disturbed should always be interrogated with Pulsed Doppler. The highest peak systolic velocity should be measure at the site of the disturbance or narrowing ( $V_s$ ) and in a normal area of the artery just proximal to the narrowing ( $V_p$ ). Care should be taken to ensure that Doppler angle is consistently 60 degrees or less on each image when recording velocity measurements. The main criterion used to grade the degree of narrowing in the artery is the ratio of  $V_s$  to  $V_p$ , 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 generally represent normal flow/vessels, whereas monophasic/damped waveforms usually represent the presence of proximal/distal disease.

For bypass graft assessment, 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.

In cases of diameter mismatch (e.g. large diameter graft joined onto a smaller diameter outflow vessel), consideration can be given to using a distal peak systolic velocity instead of  $V_p$ .

For lower limb assessments, evaluation of the following arteries should be included, as appropriate:

- Common femoral artery (CFA)
- Proximal profunda femoris artery (PFA)
- Superficial femoral artery (SFA)
- Popliteal artery
- Tibio-peroneal trunk (TPT)

The trifurcation vessels (crural vessels) and the abdominal segment arteries are only scanned if necessary or with consultant request.

- Abdominal Aorta
- Common iliac artery (CIA)
- External iliac artery (EIA)
- Posterior tibial artery (PTA)
- Peroneal artery
- Anterior tibial artery (ATA)
- Dorsalis pedis artery (DPA)

Note:

If there is total occlusion on the ipsilateral artery, vein mapping of the lower extremities is required. Additionally, if the size or length of the vein is inadequate vein mapping of the upper extremities is added.

An appropriate number of relevant annotated images that represent the entire ultrasound examination should be stored, in accordance with local protocol and the SVT Image Storage.

## **REFERENCES:**

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5. Vascular Society Great Britain and Ireland document The Provision of Services for Patients with Vascular Disease
6. Society for Vascular Technology Chaperone Guidelines
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14. Functional Popliteal Artery Entrapment Syndrome: Poorly Understood and Frequently Missed? A Review of Clinical Features, Appropriate Investigations, and Treatment Options (2014) Matthew Hislop, Dominic Kennedy, Brendan Cramp, and Sanjay Dhupelia, Journal of Sports Medicine <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590902/> SVT Professional Standards Committee April 2021, Review date April 2024