

Document Control Page

Title:	Lower limb Arterial Duplex
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Application:	
Originated/modified by:	Helena Edlin, Lead Vascular Scientist Ming Yeung, Vascular Scientist
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Review history			
This must be completed and form part of the document appendices each time the document is updated and approved.			
Date DD/MM/YY	Version	Author	Reason for changes
03/10/2022	4	M. Yeung	Velocity criteria, scanning iliacs
06/03/2023	5	M. Yeung	Removed MRI specific details, more generic protocol

Exam Name:	Lower limb Arterial Duplex
Valid Indications:	<p>Justification:</p> <p>Duplex scanning the lower limb arteries provides anatomic and physiologic information directly from sites of arterial disease.</p> <p>The location and extent of arterial lesions, status of the inflow and quality of the distal run-off vessels are determined so that decisions can be made regarding the need for arteriography and the most appropriate interventional approach.</p> <p><u>Perform a Duplex if:</u></p> <p>ABPI<0.9 and waveforms suggest fem pop disease (and patient has already been on exercise programme)</p> <p>ABPI<0.4 and waveforms suggest iliac, fem or pop disease</p> <p>Patient has tissue loss and waveforms suggest iliac, fem or pop disease</p> <p>Pedal arteries if distal bypass being considered</p>
Vetting:	<p>Clinical Vascular Scientist:</p> <p>Vet / authorize requests prior to examination, see referral guideline doc re priority</p>
Contraindications and comments:	Contraindications:
Patient preparation before appointment:	Remove any dressings /clothing from area to be scanned

Room prep:	<p>PPE available: non-sterile gloves, plastic aprons.</p> <p>Ultrasound machine. Service and quality control test are carried out by supplier/medical physics.</p>
Staffing Roles and responsibilities	<p>Authorised to perform: Qualified Clinical Vascular Scientist with training. Trainee under supervision of qualified member of staff.</p>
Staffing levels:	<p>1 member of staff required to perform the scan An assistant may be required for complex patients with mobility issues.</p> <p><i>Staff must ensure they have been appropriately trained to perform the scan and on the equipment which is being use.</i></p>
Consumables:	<p>Ultrasound gel Tissue paper Paper roll for the couch</p>
Patient prep at appointment:	<p>Patient will be asked to remove clothing where necessary.</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>
Standard protocol:	<p><u>Thigh Arteries</u></p> <p>High frequency or low frequency array transducer can be used combined with optimal settings on the duplex machine to assess peripheral arteries.</p> <p>Patient lies supine and the limb to be scanned is externally rotated at the hip, knee slightly bent and the foot turned outwards.</p> <p>The common femoral artery (CFA) is visualised in the groin and followed proximal to the inguinal ligament. The waveform on the CFA is analysed at this point, if waveform is reduced or monophasic then proceed to assess ipsilateral Iliac artery and aorta.</p>

Waveform analysis of the contralateral CFA should also be obtained to aid Radiology team for planning intervention. Note: If monophasic on the contralateral CFA then a duplex of the contralateral iliac artery is NOT required.

The CFA is then traced distally until the proximal profunda femoris (DFA) and superficial femoral arteries (SFA) are identified. The SFA is traced through the adductor canal. Colour flow is optimised to highlight areas of flow disturbances, which can then be interrogated using spectral Doppler to assess severity of the lesion.

Patient either lies supine with leg flexed at the knee ~30° or patient may lie prone. The popliteal artery is identified behind the knee and traced proximally to ensure that the full length of the artery through the adductor canal is visualised and assessed

Peak systolic velocity readings and waveform shapes from spectral Doppler are recorded throughout CFA, proximal DFA, SFA and popliteal artery. If an area of stenosis is identified, a peak systolic velocity reading is taken immediately proximal to, and at the narrowest point of the diseased section. Colour/power and spectral Doppler assessments are used to decide whether the disease is a stenosis or complete occlusion. The diseased length and location is recorded and any obvious collateral vessels are noted.

Calf Arteries – scanned only on request of the consultant

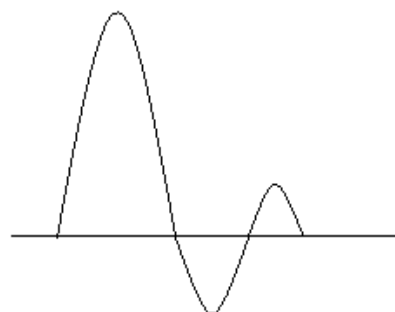
Starting at the ankle, the posterior tibial artery is identified posterior to the medial malleolus and is traced proximally. The peroneal artery is visualised deep to the posterior tibial artery and both can be assessed through the length of the calf in this plane to the tibio-peroneal trunk.

Dorsalis pedis and Anterior tibial artery is identified on the anterior-lateral aspect of the ankle and traced to the upper calf to the distal popliteal artery.

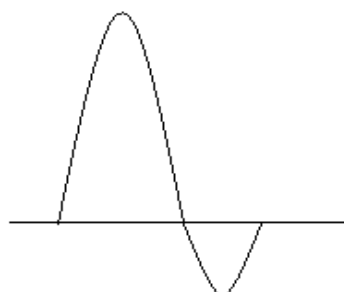
Peak systolic velocities and waveform shapes from spectral Doppler are recorded from all calf arteries at the ankle, proximal calf, at each of the run-off artery origins and at any site of stenosis.

	<p>Diameter measurements should also be taken to guide optimum location of anastomosis site (minimum diam 1mm)</p> <p><u>Iliac Arteries – scanned only on request of the consultant</u></p> <p>Low frequency curvilinear array transducer is used combined with the optimal setting on the duplex machine.</p> <p>Patient lies supine with the head supported by a pillow and a pillow is placed under the knees to help relax the abdominal muscles.</p> <p>The Iliac arteries are examined along their length from aortic bifurcation to the inguinal ligament. Colour flow is optimised to highlight areas of flow disturbances, which can then be interrogated using spectral Doppler to assess severity of the lesion. Peak systolic velocity readings and waveform shapes from spectral Doppler are recorded throughout.</p> <p><u>Popliteal Entrapment – perform only on request</u></p> <p>Perform resting ABPI +/- exercise ABPI depending on symptoms. (see separate protocol). Patient may lie prone on examination couch or stand for this assessment. Use linear array transducer, locate the popliteal artery and obtain waveform at rest. Then keep transducer at the distal popliteal artery in longitudinal view. Ask patient to perform plantar and dorsi-flexion, assess and record for any waveform changes or raised velocities caused by compression of artery.</p> <p><u>Images:</u></p> <p>Patency and waveforms at the CFA, PFA origin, Prox, Mid and Distal SFA and Prox and distal Pop A.</p> <p>Patency and waveforms at the TPT</p> <p>Any stenosis showing length and spectral trace pre and at this site.</p>
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	<p>If calf arteries are requested: Prox, Mid and Distal AT, PTA, DPA and Peroneal A patency and spectral trace</p> <p>If specifically requested: calf artery patent luminal diameter, length of patent segment and PSV at this site. Any stenosis.</p> <p>Any other pathology</p>
Troubleshooting:	<ul style="list-style-type: none"> • Obesity may produce suboptimal views of the areas of interest, which result in an inconclusive examination. • Presence of arterial calcification causes acoustic shadowing to occur therefore visualisation and quantification of stenosis becomes difficult. • Extensively oedematous legs can be difficult to scan as oedema manifests as fluid between the interstitial spaces creating a marbled effect on the image and placing the vessels further away from the transducer. • Cardiac arrhythmia affects the spectral Doppler waveform and rapid atrial fibrillation can completely destroy the usual flow characteristics.
Patient Discharge	<p>Inform the patient that the consultant will give them their results at their next visit.</p>
Reporting	<p><u>Results</u></p> <p>Spectral Doppler waveform characteristics</p> <p>Triphasic waveform - normal flow</p>



Biphasic waveform - abnormal or loss of last component due to increasing age



Monophasic waveform - disease present proximal to pulse point



The absolute value of PSV does provide a good indication of disease but is affected by cardiac output and proximal disease, therefore the peak systolic velocity ratio (PSVR) is used instead as it is more accurate in grading disease and is not affected by cardiac function, proximal disease, peripheral resistance and vessel compliance. The PSVR is calculated by dividing the maximum peak systolic velocity at the site of stenosis by the maximum peak systolic velocity proximal to the stenosis.

$$\text{PSVR} = \frac{\text{max PSV at stenosis site}}{\text{max PSV proximal to stenosis}}$$

PSVR (Vs/Vp)	% stenosis
<2.0	0-50
2.0 - 3.9	50 - 74
> 4.0	75 - 99
Absence of flow	100

If you feel that the patient requires a medical opinion, keep the patient in the department whilst you/someone speaks with a member of the Vascular team.
Write on report that you have sought advice from the vascular team and what the outcome was.

	<p>Report</p> <p>The reporting should include:</p> <p>Which arteries have been assessed commenting on the presence/absence of flow</p> <p>The anatomical position and length of any occlusions or stenoses e.g. x cm in length stating y cm above the medial femoral condyle</p> <p>Comment whether disease appears chronic or acute.</p> <p>The anatomical position and size of any aneurysms</p> <p>Any limitations e.g. difficult examination due to body habitus</p> <p>An appropriate number of annotated images that represent the entire ultrasound examination - in accordance with local protocols and SVT Image Storage Guidelines (1)</p> <p>Where possible a pictorial report is preferred by the clinicians. Ensure diagram report is labelled and annotated of the vessels assessed. Diagram report should be uploaded onto Sectra PACS.</p>
Patient and staff safety	<ul style="list-style-type: none"> • Use output powers quoted by the manufacturer and in accordance to ALARA / AIUM criteria. • Infection control: see latest Vascular Lab Infection control and working practices policy. • Couch and chair should be adjusted to optimum height to avoid work related upper limb disorder.
References & Bibliography	<ol style="list-style-type: none"> 1. Society for Vascular Technology Professional Standards Committee Image Storage Guideline April 2012 2. Peripheral Vascular Ultrasound. How, Why and When. A, Thrush and T Hartshorne 3. Society for Vascular Ultrasound Vascular Technology Professional Performance Guidelines