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| Clinical Protocol **Lower limb arterial Duplex** | |
| **SETTING** | Vascular Science Unit |
| **FOR STAFF** | Clinical Vascular Scientists |
| **PATIENTS** | All patients referred for a lower limb arterial duplex |
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**INTRODUCTION**

A lower limb arterial duplex is a B mode, colour and spectral Doppler examination of the arteries of the lower limb from aorta to ankle. The aim is to determine the location and extent of any arterial disease in order to guide treatment. The investigation can identify atherosclerotic disease (stenosis or occlusion), aneurysmal disease, dissection or vasculitis.

**This protocol should be read in combination with the Vascular Science generic protocol which covers preparation, patient communication, environment, equipment, workforce, health & safety, infection control and equality & diversity.**

**NICE GUIDELINES**

NICE guideline CG147 (2012) and NICE CKS peripheral arterial disease (2019) relates to the diagnosis and treatment of peripheral arterial disease. They state:

* Assess people with suspected peripheral arterial disease by measuring the ankle brachial pressure index (ABPI). This should be undertaken by an experienced operator using validated equipment [1].
* Offer duplex ultrasound as first‑line imaging to all people with peripheral arterial disease for whom revascularisation is being considered [2].
* Offer contrast‑enhanced magnetic resonance angiography to people with peripheral arterial disease who need further imaging (after duplex ultrasound) before considering revascularisation [2].
* Offer computed tomography angiography to people with peripheral arterial disease who need further imaging (after duplex ultrasound) if contrast‑enhanced magnetic resonance angiography is contraindicated or not tolerated. [2].
* If critical or acute limb ischemia is suspected a patient should have**emergency assessment by a vascular specialist [1].**

**REFERRAL PATHWAY**

Referrals can be made by vascular consultants, vascular nurse specialists and podiatrists for patients with clinical suspicion of lower limb arterial disease. Referrals may also be received from other doctors within the trust following discussion with the vascular team.

Referrals are triage by Vascular Scientists. Where possible an ABPI should always be carried out prior to a full duplex. If the ABPI is normal a clinical decision can be made by the Vascular Scientist whether to progress with a full duplex.

**CLINICAL INDICATION**

Common indications for a lower limb arterial duplex are:

* Intermittent claudication
* Ischemic rest pain
* Critical limb ischemia
* Gangrene
* Ulceration
* Post-surgical intervention follow-up (e.g. angioplasty, graft or stent patients)
* Suspicion of aneurysm, false aneurysm or arteriovenous fistula

**CONTRAINDICATIONS**

There are no known major contraindications for lower limb arterial duplex ultrasound. [insert SVT reference]

**LIMITATIONS**

Limitations to lower limb arterial assessment include:

* Bowel gas
* Stoma bag
* Heavily calcified arteries
* Obesity or lower limb swelling
* Open wounds or ulceration
* Dressings
* Uncooperative patients
* Patient discomfort
* Poor patient mobility or existing co-morbidities resulting in a sub-optimal patient position (eg. examination performed with the patient in a chair or upright position)
* Examinations undertaken portably at the patient’s bedside maybe limited due to equipment and room dimensions

**EQUPIMENT SPECIFICATION**

*For accessory equipment, maintenance, QA, calibration and ultrasound safety please refer to the generic vascular Science protocol.*

GE Logic 9 ultrasound machines are used for lower limb duplex assessment. The 1-5MHz curvilinear transducer is routinely used for aortoiliac vessels or large limbs. The 5-9MHz linear array transducer is routinely used for the femoral to run-off vessels. The lower extremity arterial pre-set should be used as standard.

All equipment has regularly safety checks and maintenance.

**PREPARATION**

*For test preparation applicable to all assessments please refer to the generic vascular Science protocol.*

**PATIENT COMMUNICATION**

*For patient arrival and waiting time, introduction, information and consent please refer to the generic vascular Science protocol.*

**Clinical history and presenting Symptoms**

The written referral for the investigation should contain a relevant clinical history. This should be confirmed and clarified with the patient prior to the starting the examination. A relevant lower limb arterial duplex clinical history should be taken including:

* Presenting symptoms – location, character, onset, duration, frequency, severity and progression
* Does anything relieve or worsen symptoms
* Does the patient get leg pain when walking (if this is not the presenting complaint)
* Does the patient have any leg ulceration/discolouration
* If indicated ask the patient to confirm previous intervention including date, anatomical location, hospital site

**Relevant risk factors**

Assess the patient’s relevant risk factors to include:

* Smoking history
* Hypertension
* Ischemic heart disease
* Diabetes

**STANDARD OPERATING PROCEDURE**

Please see the lower limb arterial duplex SOP

An ABPI assessment should be performed prior to lower limb arterial assessment, please refer to the ABPI VSU clinical protocol and SOP.

**REPORTING**

The lower limb arterial duplex is reported on CRIS and the vascular science database. The standardised CRIS report should be used wherever possible (see appendix 1). Additional comments can be added when necessary. A schematic is also completed and uploaded to CRIS, patient folder and NBT transfer folder (see appendix 2).

All reports should include:

* Type of scan ‘LOWER LIMB ARTERIAL DUPLEX’
* Symptoms and relevant clinical history (as stated above)
* Relevant risk factors (as stated above)
* Clinical report – see below
* Name of Vascular Scientist performing scan
* VSU end of report statement
* VSU contact phone number

**Clinical report**

Following the criteria set out in table 1, the absence of disease or, if present, the type of disease with reporting comments, the peak systolic velocity (PSV) and the waveform (tri/bi/mono) for each of the following arteries should be reported:

* Aorta
* Common iliac artery (CIA)
* internal iliac artery (IIA) (origin)
* External iliac artery (EIA)
* Common femoral artery (CFA)
* Profunda femoris artery (PFA)
* Superficial femoral artery (SFA)
* Popliteal artery (POPA)
* Tibial peroneal trunk (TPT)
* Posterior tibial artery (PTA)
* Peroneal artery (PA)
* Anterior tibial artery (ATA)

*Example: SFA (mid): 3cm 50-75% STENOSIS (PSVR 3, PSV 280cm/s, mono)*

**Table 1. Reporting criteria**

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| **Type of disease** | **Reporting comments** |
| No disease | * Normal |
| Atherosclerotic disease, but <50% stenosis | * Location of disease (proximal, mid or distal) * Nature of disease   + Mild /moderate/severe   + Irregular/smooth   + Calcified   + Calcified plaque   + echolucent/homogenous |
| Atherosclerotic disease, but >50% stenosis | * Degree of stenosis – using the grading criteria in table 2 * Length of stenosis * Location of stenosis (proximal, mid or distal) * Peak Systolic Velocity Ratio (PSVR) * If appropriate, the nature of disease   + Irregular/smooth   + Calcified/echolucent/homogenous |
| Occlusion | * Proximal to distal extent * Acute or chronic (if able to determine) * Presence of collateral vessels |
| Aneurysm | * Maximum inner-to-inner transverse and longitudinal anterior-posterior diameter measurement (to 1 decimal place) |
| Dissection | * Proximal to distal extent |
| Poor views/unable to visualise | * Reason for poor views/unable to visualise |
| Not assessed | * Reason for not assessing |

* Any limitations or low confidence measurements should be clearly stated in the report
* Any incidental findings should be documented, reported and acted upon appropriately
* A summary of the lower limb assessment should be included at the end of the report

**Table 2.** Grading criteria

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|  | Degree of stenosis | Peak systolic velocity ratio (PSVR) |
| Minimal-Mild | <50% | <2:1 |
| Mild-Moderate | ~50 | 2:1 |
| Moderate | 50%-75% | >2 but <4 |
| Severe | >75% | >4:1 ratio |
| Trickle flow | Sub-occlusion | Very low flow Pre-occlusive vessel |
| Occluded | Occluded | No Doppler signal, Colour or Power Doppler |

**Urgent findings**

If an outpatient presents with acute limb ischemia the vascular consultant on call should be contacted immediately after the scan and informed of the results of the Duplex scan.

If an outpatient patient presents with acute tissue loss, ulceration or rest pain email the referring consultant and BBW vascular network marking for urgent review - [nbn-tr.bbwvascularnetwork@nhs.net](mailto:nbn-tr.bbwvascularnetwork@nhs.net).

If an inpatient presents with evidence of critical or acute limb ischemia, acute tissue loss or ulceration the referring clinician (if not an vascular consultant) should be informed of the results and advised to contact vascular surgery at NBT immediately if this has not already been done so.

**RELATED DOCUMENTS AND PAGES**

Lower limb arterial Standard Operating procedure

ABPI clinical protocol

ABPI standard operating procedure

Vascular Science generic protocol

Bristol, Bath and Weston Vascular Network Standard Operating Procedures for Clinical Vascular Scientists

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| **Table A** | |
| **REFERENCES** | NICE CKS: Peripheral arterial diseaseNICE. Peripheral arterial disease: diagnosis and management. Clinical guideline [CG147] |
| **RELATED DOCUMENTS AND PAGES** | Lower limb arterial Standard Operating procedure  ABPI clinical protocol  ABPI standard operating procedure  Vascular Science generic protocol |
| **AUTHORISING BODY** | Vascular Science |
| **SAFETY** | Please refer to the Vascular Science Unit Health and Safety policy |
| **QUERIES AND CONTACT** | Vascular Science Unit  A225  Bristol Royal Infirmary  Upper Maudlin Street  Bristol, BS2 8HW  Tel: 0117 342 7530  Email: VSU@UHBristol.nhs.uk or uhb-tr.vascular-science@nhs.net |

**Appendix 1** – Report Template

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| Phrase: UAILBND | LOWER LIMB ARTERIAL DUPLEX:  SYMPTOMS:  Aorta D.Dcm  RIGHT/LEFT SIDE  CIA  IIA (origin)  EIA  CFA  PFA (origin)  SFA (proximal)  SFA (mid)  SFA (distal)  POP  TPT  PTA  ATA  PER  SUMMARY RIGHT/LEFT LEG:  Scanned by:  CIA Common iliac artery, EIA External iliac artery, IIA Internal iliac artery, CFA Common femoral artery, PFA profunda femoral artery, SFA Superficial femoral artery, POP Popliteal artery, TPT Tibio-peroneal trunk, ATA Anterior tibial artery, PTA Posterior tibial artery, PER Peroneal artery.  Any queries please contact Vascular Science on 0117 34 27530. |

**Appendix 2 -** Schematic

