



## Image Protocol – PACS

### Change History:

Version Number	Reason for Change	CRN	Effective Date
01	New Issue	n/a	05/04/2013
02	Additional protocols	103	06/03/2014
03	Addition of vein map protocol	134	17/12/2015
04	Protocol amendments	161	16/06/2016
05	Change order of modality protocol	193	05/10/2017
06	Addition of UHSM AAA/EVAR protocol	194	20/10/2017
07	Alter popliteal vein protocol	209	23/01/2018
08	Amend upper limb DVT protocol	255	12/11/2019
09	AAA amendment	263	06/02/2020
10	AVP removal	292	26/01/2023
11	GCA addition	304	01/02/2023
12	GCA measurement	339	28/04/2023
13	Removal of 5 sec cine loop at UHSM	383	31/01/2024
14	Scope to save images addition, probe orientation standardisation, removal of DIEP	410	04/03/2024

Prepared By	Date	Approved by	Date
T.Gall	05/04/2013	IVS Board	05/04/2013

Document control - R.Pole  
Version 14 – 04/03/2024. Review date – 04/03/2025



**Image recording protocol for Picture Archive and Communication system (PACS)**

Guidance from the Royal College of Radiologists in 2011 (1,2) state that recorded images form part of the patient record, together with the written report of the investigation. They therefore need to be stored and treated as patient record documents.

Ultrasound is a dynamic imaging modality and recording and storing of images are vital part of the process to diagnose disease or exclude disease and to produce a written report. The scope and purpose of recording and saving images to PACS is multifactorial:

1. They are a record of findings showing disease and measurements taken and adherence to scanning protocol, as well as demonstrating normality.
2. They support report writing and should back up and verify the written report.
3. They allow for review in a training situation and in follow-up patients undergoing surveillance.
4. They provide quality assurance.
5. They provide evidence that the examination was carried out to a competent standard.
6. They provide evidence that companywide, local and site-specific protocols were followed.
7. They may be used in teaching, reporting unusual cases and audit.

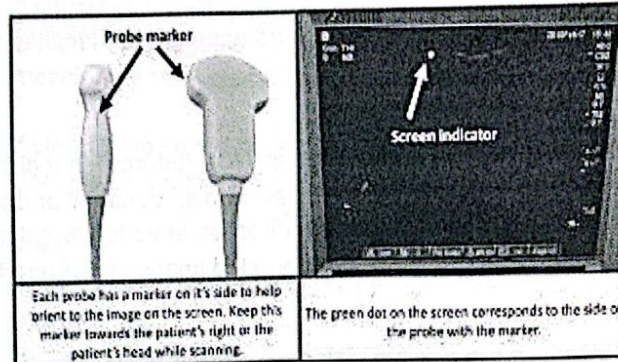
**Probe orientation standardisation:**

Document control - R.Pole

Version 14 – 04/03/2024. Review date – 04/03/2025

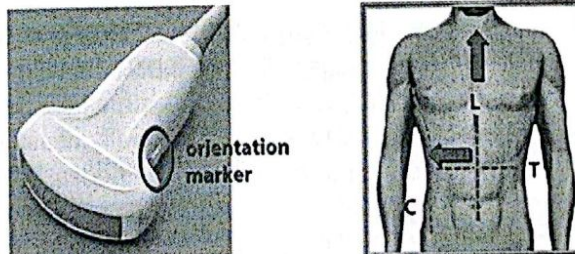


A standardised orientation is used when producing and storing images so that anyone reviewing the images can identify the view. Most probes have a notch. The notch represents the same side as the dot located on the ultrasound screen. It is good practice to identify this (sometimes tapping on the probe is valuable to confirm setting) prior to scanning to ensure the correct orientation if gained.



Standard orientation always has the notch on the probe to either:

- The patient's head for all longitudinal scans
- To the patient's right when scanning the abdomen
- To the patient's center for transverse scans when scanning the neck, lower and upper limbs



The orientation marker should be pointed:

- To the patients right side of the patient for a transverse scan
- To the patients head for a longitudinal scan

Source: Manoj K. Karmakar, Edmund Soh, Victor Chee, Kenneth Sheah:  
*Atlas of Sonoanatomy for Regional Anesthesia and Pain Medicine*  
Copyright © McGraw-Hill Education. All rights reserved.

### Image acquisition protocol:

Document control - R.Pole  
Version 14 - 04/03/2024. Review date - 04/03/2025





All images must be labelled with anatomy and orientation (LS view, TS/AP view).

Ensure all patient data is entered as appropriate.

This list is not exhaustive, it is a minimum requirement. Other images can be captured at the users discretion especially if abnormal/ unusual pathology is noted.

All standard images should be recorded and appropriately labelled with minimum number of images as below:

1. **Carotid –**
  - a. Right/Left side - CCA, ECA and ICA (bifurcation if diseased) demonstrating colour and waveforms. Vertebral and subclavian arteries demonstrating flow direction in vertebral, colour and waveforms. High quality grey scale image of ICA and bifurcation.
2. **TCD – no images taken**
3. **Peripheral Arterial and waveform assessment – Right and left CFA, POP, PTA and ATA waveforms.**
4. **Lower limb arterial – CFA, PFA, SFA origin, mid and distal unless diseased and then demonstrate stenosis with waveforms. Popliteal and TPT. Waveforms at ankle from PTA, ATA and PerA if visualised.**
5. **Lower limb venous DVT-**
  - a. Right/left leg - CFV including Valsalva, PFV, SFV origin and distal, Popliteal. Only take image in the calf if DVT identified or differential diagnosis e.g. Muscle tear, Baker's cyst, superficial oedema or thrombo-phlebitis. Need to record images with measurements of abnormal masses such as enlarged lymph nodes, Bakers cysts, muscle tears. If required to demonstrate occlusive vein or compressibility use dual image function to show venous compression.
6. **Lower limb venous Varicose vein –**
  - a. Right and left legs
    - i. Follow deep venous protocol as above
    - ii. Superficial junctions demonstrating competence/incompetence
    - iii. Sections of LSV in thigh and calf demonstrating competence/incompetence and TS images showing diameters for VNUS suitability if required





- iv. Section of SSV in mid calf demonstrating competence/incompetence and TS images showing diameters for VNUS suitability if required

**7. Vein mapping for bypass conduit:**

- a. For LSV -  
If suitable vein: One image showing CFV/SFJ and competency.  
B-mode TS images of proximal, mid and distal thigh with diameter measurement. Proximal, mid and distal calf with diameters.
- b. If Unsuitable vein: one image showing reason for non-suitability eg. Varicose, superficial thrombo-phlebitis.
- c. For SSV-  
If suitable vein and patent junction: One image showing PopV/SPJ and competency.  
B-mode TS images of proximal, mid and distal calf with diameter measurement.

**8. Transvaginal Duplex Ultrasound for pelvic vein reflux –**

- a. Bilateral internal iliac vein (IIV) and bilateral ovarian vein (OV) in sagittal view. Annotate images to include: vessel diameter, reflux time during/release of Valsalva. Annotate scan position (supine/ semi-standing). If post-embolisation annotate images showing coils in situ.

9. **Aorto-iliac** – aorta in LS and TS demonstrating normal or aneurysmal pathology. Aortic bifurcation and CIA and EIA where possible with colour and waveforms. CEUS and 3D – aneurysm in LS, TS demonstrating sac, endoleak

A tortuous Abdominal Aorta can lead to measurement errors depending on the angle of the Abdominal Aorta and caliper placement. Oblique measurements of the Abdominal Aorta may cause overestimation of the diameter.

Care should be taken when measuring the Aorta to ensure that the diameter is not taken at an oblique angle as per IVS training. The probe should be adjusted by the Vascular Scientist to ensure the maximum diameter of the Aorta is taken perpendicular to blood flow. Vascular Scientists can 'heel -toe' the probe to a more accurate angle to ensure the true AP measurement is achieved. The entire length of the Abdominal Aorta should also be scanned to



identify any vessel tortuosity or the presence of fusiform or saccular aneurysms.

**10. Visceral assessment –**

- a. Proximal abdominal aorta LS with waveform demonstrating any disease.
- b. Coeliac axis (where possible) with colour. demonstrating any disease
- c. Hepatic and splenic arteries – colourflow and spectral waveforms demonstrating any disease
- d. SMA- Colour image and with spectral waveform, SMA diameter, demonstrating any disease
- e. IMA – if identified, colour image and spectral waveforms, demonstrating any disease

**11. Upper limb arterial** – VA direction, subclavian, axillary, brachial, brachial bifurcation, radial and ulnar waveforms at wrist with colour and waveforms.

**12. Upper limb venous** – IJV, subclavian vein, axillary vein, brachial veins – waveforms to demonstrate phasicity. Only take images of basilic and cephalic veins if there is evidence of superficial venous pathology/thrombo-phlebitis.

**13. Fistula** – radio-cephalic – subclavian and waveform, brachial and waveform, radial artery prox and distal to fistula with waveform. The anastomosis with velocities and diameter. Fistula image with colour, outflow/ cephalic vein with three volume flow measurements and vessel diameter. Record on image location of volume flow and diameter in relation to elbow crease.

**14. GCA** – Bilateral Superficial Temporal artery, frontal and parietal branches, and axillary arteries with colour flow image in TS and LS. IMT measurements of bilateral Superficial Temporal artery, frontal and parietal branches, and axillary arteries in TS with colour flow. Spectral waveforms only if stenosis present. In the presence of hypoechoic halo, TS and LS with colour flow Doppler including IMT measurement (US machine measures in cm however in the scan report should reported be in mm).

**References:**

1. RCR position statement on the Records Management Code of Practice for Health and social care 2016: application of the Code to radiology records retention protocols December 2017



Doc Ref: CL9.050413.14

Page 7 of 7

[https://www.rcr.ac.uk/sites/default/files/position\\_statement\\_records\\_management\\_code\\_practice.pdf](https://www.rcr.ac.uk/sites/default/files/position_statement_records_management_code_practice.pdf)

2. Guidelines and standards for implementation of new PACS/RIS solutions in the UK (2011) The Royal College of Radiologists.BFCR(11)4  
<https://www.rcr.ac.uk/publication/guidelines-and-standards-implementation-newpacsris-solutions-uk>





## Protocols for non-invasive and minimally invasive assessments

### Independent Vascular Services Ltd

#### Change History:

Version Number	Reason for Change	CRN	Effective Date
01	New issue	n/a	01/01/2013
02	Change layout		01/03/2013
03	Additions of CEUS/HAVS protocols	103	26/02/2014
04	Additions to Carotid/venous protocols	107	25/07/2014
05	Amendment to Macc rescan protocol	112	06/11/2014
06	Amendments to toe pressures	118	19/03/2015
07	Addition of ECA criteria	125	27/04/2015
08	Addition of Warrington DVT protocol	126	25/06/2015
09	Change in venous protocol	155	11/03/2016
10	Change to abdominal protocols	171	4/10/2016
11	Change to lower limb venous protocol content/layout	172	4/10/2016
12	Addition of MALS protocol	173	4/10/2016
13	Addition of PAES protocol	174	4/10/2016
14	Addition of upper limb venous protocol	175	3/11/2016
15	Addition to popliteal entrapment protocol	183	11/03/2017
16	Addition SM Beacon protocol, removal Macclesfield rescan policy	185	24/04/2017
17	Addition of UHSM specific protocols	195	20/10/2017
18	Addition of Stepping Hill DVT protocols/local CIA aneurysm screening protocols	213	30/01/2018
19	Lower limb arterial velocity ratio protocol	225	27/02/2018
20	AAA ML measurement amendment	238	20/07/2018
21	Units of measurement amendment	242	11/02/2019
22	NM DVT rescan change	259	15/01/2020
23	AAA amendment	262	06/02/2020
24	Carotid velocity change/Reduced term clarification	279	17/02/2021
25	Iliac DVT scanning rationale	286	09/08/2021



26	Removal of AVP	291	26/01/2023
27	Thigh venous reflux – dependent angle	296	29/01/2023
28	GCA protocol/CEUS reference	306	01/02/2023

Prepared By	Date	Approved by	Date
T.Gall	01/01/2013	R.Pole	01/01/2013

<u>Contents</u>	<u>Ref.</u>	<u>Page no.</u>
<b>1.Patient identification preparation and care</b>	<b>CL1.1</b>	<b>4</b>
<b>2.Basic guidelines</b>	<b>CL1.2</b>	<b>6</b>
<b>3.Carotid/subclavian/vertebral duplex assessment</b>	<b>CL1.3</b>	<b>7</b>
<b>4.Trans cranial Doppler assessment</b>	<b>CL1.4</b>	<b>14</b>
a)Pre-operative		
b)Intra-operative		
c)Post-operative		
d)Patent foreman ovale – assessment		
e)Oximetry		
f)Cerebral reactivity		
<b>5.Peripheral waveform assessment</b>	<b>CL1.5</b>	<b>18</b>
Pole Test		
<b>6.Lower limb arterial duplex assessment</b>	<b>CL1.6</b>	<b>24</b>
a)Thigh arterial		
b)Calf arterial		
c)Prosthetic graft surveillance		
d)Vein graft surveillance		
e)Stent/angioplasty surveillance		
f)Pseudo-aneurysm compression		
g)Popliteal artery entrapment syndrome		
<b>7.Lower limb venous duplex assessment</b>	<b>CL1.7</b>	<b>32</b>
a) General		



- b) Deep venous thrombosis assessment
- c) Varicose vein assessment
- d) Venous marking
- e) LSV and SSV mapping

**8.TVDU for pelvic vein incompetence** **CL1.8** **40**

**9. Aorto-iliac duplex assessment** **CL1.9** **42**

- a) Aorto-iliac segment
- b) Aortic aneurysm/ EVAR repair
- c) Contrast EVAR and 3D

**10.Visceral artery assessment** **CL1.10** **52**

- a)Anatomy
- b)Mesenteric arteries
- c)Renal arteries

**11. Upper Limb arterial assessment** **CL1.11** **60**

- a)Arterial pressures and waveforms
- b)Duplex – arm arteries
- c)Thoracic Outlet Syndrome
- d)Radial artery conduit assessment
- e)Hand-Arm Vibration Syndrome Assessment

**12. Upper limb venous assessment** **CL1.12** **67**

**13. Arterio-venous fistula assessment** **CL1.13** **70**

**14. Deep inferior epigastric perforator assessment** **CL1.14** **76**

**15. Temporal and Axillary artery assessment** **CL1.15** **80**





**CL1.1**

**1. Patient Identification, preparation and care**

- a) Notes and/or referral letter should be read prior to approaching patient to confirm examination type.
- b) Patient should be identified in the waiting area by name alone.
- c) Patient should be directed to the examination room with aid from the clinical vascular scientist, CVS, (if necessary). If patient is a child or vulnerable adult then always scan in the presence of a parent/carer.
- d) Once in the examination room, the CVS should identify themselves, and then the patient details should be confirmed by name, date of birth, and address. These details should be added to the examination sheet.
- e) Patient should be asked what symptoms they have been experiencing or 'do they know why they are here?'
- f) CVS should explain briefly what they intend to do, gain verbal informed consent and put the patient at ease. For examination using contrast agents written consent should be obtained.
- g) If consent not obtained patient should be directed back to ward/physician or A&E etc. Report on database patient attended but refused scan and any details surrounding visit. Log refusal on incident log on shared drive.
- h) Patient is then asked to remove any necessary clothing or jewellery (with help of CVS if required). Explain that the gel is hypo-allergenic and water soluble so will not stain clothes.
- i) CVS should assist the patient on to the examination couch and ensure patient is comfortable, (do not lift patients – mandatory manual handling instruction).
- j) Examination is performed as per relevant protocol.
- k) Patient should be assisted off the couch once they feel able, (do not lift patients). CVS should warn the patient that they may feel dizzy or lightheaded if they sit up too quickly.
- l) CVS should explain where the results will be forwarded and who will explain the results. CVS could estimate a timeframe for the results to reach the referring clinician. CVS should not explain the outcome of the examination unless specifically directed by referring clinician.
- m) CVS needs to arrange equipment to ensure maximum possible comfort and to reduce the likelihood of musculo-skeletal injury.



- n) If there is an unexpected diagnosis that requires urgent clinical management then staff should understand the importance of contacting the vascular team on-call and trying to get the patient an urgent vascular opinion. See 'Red Flag policy' on shared drive.
- o) If you require to mark the skin, please use the sterile disposal pens and tape measures available. Do not use normal pens to mark the leg – this is a cross infection risk.
- p) It is standard policy to issue a report as soon as possible after the completion of the report. Reports from all patients are issued either in an electronic or paper format within 8 hours of completion of the vascular ultrasound report. If inpatient or Red Flag patient the vascular ultrasound report is placed in the notes or placed electronically on the host Trust wide reporting system within 10 minutes. If a Red Flag patient then the report will be immediately faxed to the consultant with a follow up phone call to ensure that it has arrived.



CL1.2

## 2. Basic guidelines

### **Basic colourflow set-up**

Whilst visualising a vessel optimum colourflow is described as wall-to-wall filling of the vessel without colourflow scatter outside the vessel wall. This can be achieved by selecting the appropriate default setting, steering the colourflow box and adjusting the colourflow gain, wall filter and colourflow velocity functions. In addition, the colour velocity range needs to be set to allow slight aliasing.

### **Velocity measurements**

The Doppler sample volume is placed in the area of fastest flow (as indicated by the colourflow map). The angle correct line should be set at 60 degrees and should lie parallel to the blood flow achieved by 'tip-toe' the transducer movement. If transducer movement cannot achieve parallel flow then the angle correct line should be altered to lie parallel with the blood flow, (but angle should be less than 60 degrees).

### **Safety of Ultrasound and ALARA Principle**

There are two documented potential mechanisms for ultrasound to cause harm to patients. These are heating of soft tissue and cavitation<sup>2,4,12</sup>.

Both of these bio-effects are related to output intensity and exposure time to ultrasound. The potential for thermal heating is displayed as the TI or thermal index and the potential for cavitation as MI or mechanical index.

There are three options for TI, being TIS – thermal index in soft tissue, TIB – thermal index with focus close to bone and TIC for trans-cranial imaging applications<sup>2</sup>.

There are no documented index thresholds for the different modality and control settings. The principle universally accepted by all ultrasound practitioners is the ALARA or 'As low as reasonably achievable' principle. This means that the total output energy applied to the patient must be kept as low as possible by reducing output power to its lowest level without compromising on image quality and by limiting exposure time without rushing a scan<sup>12</sup>.

It is the clinical vascular scientists' responsibility to control the total energy emitted to the patient and must reconcile exposure time with diagnostic image quality<sup>12</sup>.



**CL1.5****5. Peripheral waveform assessment and segmental pressure ratios****General**

The continuous wave Doppler probe is placed directly above the vessel at a 45-60 degree angle to the skin surface<sup>1</sup>. Slow movements are used to identify the loudest volume signal then adjustments are made to the angle to achieve the optimum Doppler signal<sup>2</sup>. Alternatively the assessment can be completed using pulsed wave duplex ultrasound.

Patient is rested supine for at least 10 minutes – during this time waveforms can be taken. If patient is unable to lie flat, ABPI should still be taken but the patient position should be noted in the report<sup>2,4</sup>. If it is not possible to obtain ABPI – the reason for not being able to obtain ankle or arm pressures needs to be stated in the report<sup>2,3</sup>.

**Technique**

The common femoral artery is located in the groin using a 12-3MHz probe. Once the optimum signal is achieved, the waveform shape and quality (triphasic, biphasic or monophasic) are recorded<sup>4</sup>. The strength (volume) of the signal is recorded as either: - good, slightly reduced (slow systolic rise time), reduced (slow systolic rise time, damped sound), weak (?arterial/venous) or absent<sup>1,6</sup>.

The patient's leg is flexed to a 45 degree angle and the 12-3MHz probe is placed in the popliteal fossa. The popliteal artery Doppler waveform signal is recorded<sup>2</sup>.

A 12-3MHz probe is placed posterior to the medial malleolus with light pressure (excessive pressure on pedal pulses may occlude the arteries)<sup>2</sup>. The posterior tibial artery is identified and the signal recorded. The same probe is then used to identify and record the strength of the anterior tibial artery on the anterior aspect of the ankle. If you are unable to access or identify the ATA and PTA, the dorsalis pedis signal on the dorsum of the foot, and the peroneal artery on the lateral aspect of the ankle can be assessed. The waveform shape and quality of all the present signals are recorded.<sup>5</sup>

A standard blood pressure cuff is placed around the right upper arm. The brachial signal is obtained using either an 8 MHz or a 4 MHz continuous Doppler probe connected to a Doppler waveform analyser<sup>2</sup>. If the Doppler waveform is of a good volume with a triphasic or biphasic waveform then the blood pressure cuff is inflated until the Doppler signals is lost. The cuff is then slowly deflated and the brachial systolic blood pressure is recorded when the Doppler signal is first heard. If the pressure in the right arm is reduced (slow systolic rise time, damped sound)/ brachial signal is poor then use the left arm<sup>1,7</sup>.

A standard cuff is placed around the ankle just above the medial malleolus. If an ulcer is present at the ankle a non-adherent dressing is placed beneath the cuff to prevent soiling. The strongest ankle signal is identified using an 8MHz continuous Doppler probe and the cuff is inflated as with the arm and the ankle systolic pressure recorded.<sup>8</sup>

**The ankle brachial pressure index (ABPI) is recorded as the ankle/brachial pressure:**

Document Control – R.Pole, Operations Director  
Version 28:01/02/2023. Review date 27/08/2023





### **ABPI < 0.8 (reduced)<sup>2</sup>**

Segmental pressures are taken using the same pedal Doppler signal but the cuffs are placed just below the knee, the just above the knee and as high as possible around the thigh<sup>2,6</sup>. This allows the operator to identify the level of disease.

### **ABPI > 0.8 (normal)<sup>2</sup>**

If patient suffers from angina or has had a recent heart attack then a foot flex exercise is performed. The technician raises the leg into the air (external support can be used – i.e. foam cushion) and the patient dorsi-flexes the foot for 1 minute after which the ankle pressure is retaken<sup>1,2</sup>.

If the patient is relatively fit with no evidence of angina and is able to walk unassisted they can perform calf raises as quickly as possible for one minute.<sup>5</sup> Patient should be stood and holding onto the handle of a stool for support while performing calf raises. The patient returns to the couch and lies supine and the pressure is retaken within 45 seconds. A fall in absolute pressure of greater than 20mmHg indicates a significant arterial stenosis<sup>2</sup>.

### **ABPI > 1.2 or incompressible at 220mmHg<sup>15</sup>**

**Toe Pressures:** Patient may have calcified arteries and pressure ratios may be unreliable. In these cases toe pressures need to be performed either manually or using the automated Atys Systoe equipment<sup>1,2</sup>. A small cuff is placed around the base of the big toe - arterial signal obtained with a handheld Doppler or PPG – wearing headphones can help. The pressure can then be obtained. A ratio of greater than 0.6 is regarded as normal, an absolute pressure of 33mmHg or less is indicative of critical ischaemia<sup>19</sup>.

### **ABPI Variability:**

How systolic blood pressure is measured in the upper and lower limbs will clearly affect the ABPI calculation:

1. The usual variation in (absolute) BP measurement is between 5-10mmHg but remember the effect of “white coat” hypertension<sup>1</sup>.  
Observer error: Due to lack of concentration, poor hearing/loud environment<sup>19</sup>.
2. Physiological/pathological variation.

Here several factors can be influential:

- a) The effect of patient positioning in relation to the level of the heart:

The patient should be supine and the equipment and limbs at heart level to reduce hydrostatic pressure inaccuracies<sup>2</sup>.

b) Cardiac dysrhythmia: if the pulse is irregular (e.g. the patient is in atrial fibrillation) or where heart rate may be as slow as ~40bpm, it is essential that very slow deflation rate is used as too rapid deflation will lead to an underestimation of systolic blood pressure<sup>2,17</sup>.

c) Technique-induced hyperaemia: Vowden et al (1996) note that repeated inflation of the cuff, or leaving it inflated for prolonged periods, can induce a hyperaemic response and hence lead to a fall in ankle pressure<sup>16</sup>.

### 3. Variation due to equipment used for blood pressure measurement

#### a. The effect of cuff size (width):

If too narrow or too short a bladder is used, blood pressure (i.e. that needed to occlude the artery) will be overestimated; this “undercuffing” will hence result in “cuff hypertension” (Beevers et al, 2001 Part I)<sup>11</sup>. Conversely, there is albeit less clear evidence that “over cuffing” (using too long or too wide a bladder) may cause an underestimation of blood pressure (Beevers et al, 2001 Part I). Zwiebel states that **the cuff width should be at least 50% greater than the diameter of the limb in which pressure is being measured. The bladder length should be at least 80% of the circumference of the limb**<sup>5,8</sup>.

#### b. The effect of cuff placement:

Anderson (2002) compared pressure and ABPI differences with cuff at ankle versus that 10cm above ankle, and found that the proximal position yields a higher pressure and ABPI by on average 4mmHg and 0.01 respectively. This was statistically but not clinically significant<sup>12</sup>.

### Waveform analysis:

This can provide much useful supplementary information to the ABPI, and yet is a poorly documented topic in the literature. One of the fundamental principles of Doppler blood flow waveform analysis is that the shape of an arterial waveform varies with the extent of proximal disease (amongst other things, such as disease at the site of measurement and distal disease, etc)<sup>1</sup>.

### Phasicity:

This is literally determined by how many ‘bumps’ are present in the contour of the waveform over one cardiac cycle<sup>1,4</sup>.





Triphasic = three bumps, biphasic = two bumps, monophasic = one bump<sup>4</sup>.

### Directionality:

With the correct equipment (ie a bidirectional HHD with a graphical chart output), one may obtain and analyse graphical representations of ankle waveforms, looking for an indication as to the status of the aorto-iliac segment, namely by looking at the phasicity and directionality of the waveform contour over one cardiac cycle<sup>1,2</sup>.

Forward and reverse flow = bidirectional.

Forward flow only = unidirectional.

Reverse flow only = unidirectional.<sup>4</sup>

In the peripheral vasculature, one may encounter the following types of waveform shape:

1. Triphasic bidirectional: Usually just referred to as triphasic, as one rarely if ever encounters a waveform with three phases that is unidirectional. This implies that the proximal vasculature is essentially normal/without significant (>50%) diameter stenosis, although in studies of the common femoral waveform it has been shown that the presence of a triphasic CFA waveform does not absolutely exclude significant iliac disease [Shalan et al 2003 showed that 89%, not 100%, of triphasic CFA waveforms had no significant (<50%) iliac stenosis]<sup>20</sup>.
2. Biphasic bidirectional: This can be associated with a mild-moderate proximal stenosis, or can indicate normal/<50% stenosis proximally (arteries that have stiffer walls due to disease, e.g. calcification, are less compliant which can result in the loss of the third phase<sup>20</sup>.
3. Biphasic unidirectional: This appearance is often called vasodilated – an essentially normal waveform with extended forward flow in diastole and no reverse flow, due to physiological change (e.g. temperature) of pathological change (e.g. ischaemia distally)<sup>1,21</sup>.
4. Monophasic: Essentially 'one bump', with or without extended/continuous forward flow in diastole. One type of monophasic waveform which is highly predictive of significant proximal disease is the damped waveform (correctly referred to as tardus parvus, namely with a slow systolic upstroke and a low peak)<sup>22</sup>.

### Pole Test

In cases when patients have incompressible calf arteries due to medial wall calcification which yield falsely elevated ABPIs - the Pole test can be used to obtain a pressure



reading at the ankle<sup>23</sup>, however it would be preferable to perform a toe pressure assessment over the Pole Test.

In the pole test, the ankle or toe pressure can be measured without a cuff, using the hydrostatic pressure induced by leg elevation and recording the height above the heart at which the pulse disappears. The height in cm is multiplied by 17.5 to calculate an absolute pressure reading<sup>24</sup>.

## REFERENCES

- 1) Thrush and Hartshorne. (2010). Vascular Ultrasound, How, Why and When. 3<sup>rd</sup> Edition.
- 2) Institute of Physics and Engineering in Medicine in association with The Society For Vascular Technology of GB & Ireland. (2001). Vascular Laboratory Practice Part VI, IPEM 1<sup>st</sup> Edition.
- 3) Rutherford RB, Baker JD, Ernst C et al. (1997). Recommended standards for reports dealing with lower extremity ischemia: revised version. Journal of Vascular Surgery 26: 517-538.
- 4) Kremkau, FW. (2011). Sonography, Principles and Industry, 8<sup>th</sup> Edition.
- 5) Zwiebel WJ, Pellerito JS. (2005) Introduction to vascular ultrasonography 5<sup>th</sup> edition. Elsevier Saunders, Philadelphia.
- 6) AbuRahma AF. (2000) Segmental Doppler pressures and Doppler waveform analysis in peripheral vascular disease of the lower extremities. In: AduRahma A F, Bergan J J (eds) Noninvasive vascular diagnosis. Springer, London, p213-229.
- 7) Polak JF. (1992). Peripheral vascular sonography. Williams & Wilkins, Baltimore.
- 8) Hamments D. (2004) Vascular Technology. The Burwin Institute. USA.
- 9) Donnelly R, Hinwood D, London JM. (2000) ABC of arterial and venous disease: Non-invasive methods of arterial and venous assessment. BMJ 320;698-701.
- 10) Wolfe JHN. (2000) ABC of vascular diseases. BMJ, St. Mary's Hospital, London.
- 11) Beevers et al. (2001) ABC of hypertension blood pressure measurement Part 1. Sphygmomanometry factors common to all techniques. British Medical Journal 322:981-985.
- 12) Anderson I. (2002). The effect of varying cuff position on recording ankle systolic blood pressure. J Wound Care 11(5): 185-9.
- 13) Scottish Medicines Consortium. (2006). Diagnosis and management of peripheral vascular disease. Available from: <http://www.scottishmedicines.org.uk>. Scottish Intercollegiate Guidelines Network (SIGN).
- 14) Scottish Medicines Consortium. (2006). Diagnosis and management of peripheral vascular disease. Available from: <http://www.scottishmedicines.org.uk>. Scottish Intercollegiate Guidelines Network (SIGN).
- 15) Rich K. (2015). Toe blood pressure and toe-brachial index. J Vasc Nurs. Dec;33(4):164-6.
- 16) Vowden KR et al. (1996). Hand-held Doppler assessment for peripheral arterial disease. J Wound Care; 5(3): 125-8.
- 17) Carser DG. (2001). Do we need to reappraise our method of interpreting the ankle brachial pressure index? J Wound Care; 10(3): 59-62.
- 18) Cheetham DR et al. (2004). Does Supervised Exercise Offer Adjuvant Benefit Over Exercise Advice Alone for the Treatment of Intermittent Claudication? A Randomised Trial. European Journal of Vascular and Endovascular Surgery.



- 19) Sumner DS. (1998). Non-invasive assessment of peripheral arterial occlusive disease. In: Rutherford KS, editor. Vascular Surgery (3<sup>rd</sup> edition) Philadelphia: WB Saunders, 41-60.
- 20) Shaalan et al. (2003). Reliability of common femoral artery haemodynamics in assessing the severity of aorto-iliac inflow. J Vascular Surgery. 37:960-9.
- 21) Hammets D. (2004). Vascular Physics. The Burwin Institute. USA.
- 22) Jian-Chu L. (2007). Evaluation of the tardus-parvus pattern in patients with atherosclerotic and non-atherosclerotic renal stenosis. 26, 4:419-426.
- 23) Pahlsson HI. (1999). The pole test for evaluation of arterial insufficiency in diabetic patients. Eur J Vasc Endovasc Surg. 26, 4:419-426.
- 24) Lazarides MK, Giannoukas AD. (2007). The role of haemodynamic measurements in the management of venous and ischemic ulcers. International Journal of Lower extremity Wounds. 6:254-267.



**CL1.6**

**6. Lower limb arterial duplex/graft surveillance/angioplasty(stent) surveillance –**

**a) Thigh arteries**

Probe types – 12-3 MHz linear array<sup>2,4,6</sup>.

Measurements – velocities in centimetres per second, diameter (anterior-posterior AP, medial-lateral ML) in centimetres, length of disease in centimetres<sup>1,2</sup>.

Patient lies supine<sup>1,7</sup>. Due to the intimate nature of the scan, a chaperone should be offered<sup>25</sup>.

The common femoral artery is visualised in the groin and followed proximal to the inguinal ligament<sup>1,2</sup>.

The common femoral artery is then traced distally to the bifurcation and the profunda femoris and superficial femoral arteries are identified. The superficial femoral is traced along its length and through the adductor canal, visualisation is improved by flexing the leg at the knee to a 45 degree angle and turning the knee outwards<sup>1,2,7</sup>.

Peak velocity readings and waveform shape and quality are recorded in the common femoral, at the profunda origin and at the superficial femoral origin, and at the proximal, mid and distal SFA<sup>2,8</sup>.

If an area of stenosis is identified a peak velocity reading is taken immediately proximal, within and immediately distal to the diseased section. The colourflow and Doppler assessments are used to decide whether the disease is a stenosis or complete occlusion. The disease length and the distance from the medial malleolus is recorded. Any collateral vessels are noted. It should be stated whether the disease appears acute or chronic. It should be made clear in the report whether the distal superficial femoral reforms a disease free segment above the knee<sup>7,8</sup>.

If there is a significant stenosis present, measure the maximum PSV through the stenosis (V2) and the PSV just proximal to the stenosis as a "normal" reference velocity (V1), to enable calculation of the velocity ratio V2/V1. Note that at the SFA and PFA origins it may not be possible to obtain a V1 measurement; the absolute PSV will then be used to grade the % stenosis. If within the SFA, mark the position and length of any significant stenosis with a single-use surgical marker pen and measure the distance to the medial malleolus<sup>3,5</sup>.

Also remember to scan contralateral CFA when performing lower limb arterial assessments. In addition to our standard protocol if a patient has an iliac occlusion/severe disease (CIA, EIA or both) please scan contralateral iliac system. This may save the patient coming to VSU twice and speeds up the whole patient management process<sup>9</sup>.

For assessment of the popliteal artery, the patient sits with legs dependent or lies flat with the leg slightly flexed at the knee and externally rotated<sup>1,2</sup>. Alternatively, having the patient lie on their side can allow a good view of the popliteal artery.

The popliteal artery is identified behind the knee and traced proximally ensuring that the full length of artery through the adductor canal is visualised and assessed<sup>2,5</sup>.

The first arterial branch of the trifurcation is the anterior tibial (may not be viewed). The tibio-peroneal trunk is traced into the upper calf until it bifurcates into the posterior tibial and peroneal arteries. Waveforms are recorded and the velocities are measured in the popliteal and at each of the run-off artery origins and in any area where a stenosis is identified<sup>2,11,12</sup>. The number of run-off vessels viewed should be documented (0-3).

#### Velocity ratios:

Comparing Peak Systolic Velocity (PSV) in reference segment proximal to lesion (V1) with maximum stenotic jet PSV (V2) gives a V2:V1 ratio (namely V2/V1) which can be used as follows<sup>1,2,10,27,28,29</sup>:

Classification (diameter reduction)	Velocity Ratio	Disease level
0-49%	<2.0	Mild
50-74%	≥2.0	Moderate
75-99%	≥4.0	Severe

#### Absolute velocities:

For use when it is not possible to obtain a suitable reference V1:<sup>24</sup>

artery	mean PSV (cm/s)	SD (cm/s)
Aorta	76	17
CIA	111	17
EIA	112	49
CFA	90	41
SFA prox	89	23
SFA mid	83	25
SFA distal	74	21
Popliteal	59	12

- ! The above table shows peak systolic velocities for normal legs.
- ! For a normal distribution, 99% of observations will fall within the range of the mean +/- 2 standard deviations.

For example, if the iliac arteries are largely obscured by bowel gas, but an isolated section of flow is seen in the EIA with a velocity of 300cm/s we can suggest that significant disease is likely. Using the mean velocity in the table above as V1, we can use the same ratio criteria to stratify the severity of disease, e.g. ≥4 would indicate severe disease.

Ankle brachial pressure indices are performed. (See Peripheral waveform assessment)





**b) Calf arteries** – Calf vessels should be scanned along their length<sup>26</sup>.

Probe types – 12-3 MHz linear array/ if needed – 5-1 MHz curved array<sup>2,4</sup>

Measurements – velocities in centimetres per second, length of disease in centimetres<sup>1,5</sup>.

Patient lies supine or sits on the edge of the bed with their legs dependent (aids visualisation with severe disease, and allows venous filling which can be used to map the course of the arteries)<sup>2</sup>.

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 (both arteries can be assessed throughout the length of the calf). If unable to visualise the peroneal artery with 12-3MHz – then you must try the 2-5 curved array, or attempt to view from an anterior approach<sup>2,12,13</sup>.

The anterior tibial artery is identified on the antero-lateral aspect of the ankle (do not apply too much pressure as the artery may be occluded by the transducer) and should be traced to the upper calf<sup>12,13</sup>.

Velocities and waveforms are recorded from all the calf arteries at the ankle and proximal calf and also at any site of stenosis.

In the presence of proximal disease, calf velocities can be unreliable and disease should be graded mild, moderate, severe or occluded<sup>1,8</sup>.

**c) Prosthetic grafts** (usually above knee femoro-popliteal, aorto-bifemoral grafts (ABG), fem-fem crossover).

Probe types – 5-1 MHz curved array, 12- 3 MHz linear array<sup>2,14</sup>.

Measurements – velocities in centimetres per second, diameter (anterior-posterior AP, medial-lateral ML) in centimetres, length of disease in centimetres<sup>1,2</sup>.

Similar scanning protocols as above, except only the segments just proximal, mid and distal to the grafts are assessed. Particular attention is paid to the proximal and distal anastomosis where waveform shapes and velocities are recorded. ABPI are taken to assess any disease progression in non-treated segments (patient has usually had a full assessment prior to surgery)<sup>16,17</sup>.

With fem-fem crossover grafts it is important to record the direction of flow through the graft<sup>1,2,18</sup>.

With ABG and fem-fem crossover grafts, the common femoral waveforms are recorded<sup>1,2,18</sup>.





Waveforms, peak velocities, ABPIs and any areas of re-stenosis/new disease are recorded<sup>17</sup>.

**d) Vein grafts (usually below knee)**

Probe types – 12-3MHz linear array<sup>2</sup>.

Measurements – velocities in centimetres per second, diameter (anterior-posterior AP, medial-lateral ML) in centimetres, length of disease in centimetres<sup>1,2</sup>.

Similar scanning protocols to above, except only the segments just proximal, mid and distal to the grafts are assessed. Care is taken to scan the length of the graft and velocities and waveforms are recorded at areas of stenosis (usually valve cusps). Waveforms, peak velocities, ABPI and any areas of re-stenosis/new disease are recorded. Avoid taking ABPI on fem-distal grafts as inflating the cuff leads to danger of occluding the graft<sup>2,19,20</sup>.

**If peak velocity is less than 45cm/s - graft is probably at risk of failure and this must be noted in the report<sup>2</sup>.**

**e) Stent/angioplasty assessment**

Probe types – 12-3 MHz linear array<sup>4,6</sup>.

Measurements – velocities in centimetres per second, diameter (anterior-posterior AP, medial-lateral ML) in centimetres, length of disease in centimetres<sup>1,2</sup>.

Similar scanning protocol to above. Care is taken particularly at the just proximal to, mid and just distal to the stent/angioplasty site. Waveforms, peak velocities, ABPIs and any areas of re-stenosis/new disease are recorded<sup>2,20</sup>.

**f) Pseudo-aneurysm diagnosis and compression.**

Probe types – 12-3 MHz linear array<sup>4,6</sup>.

Measure site of the feeder jet from the femoral bifurcation – if jet lies at or within 1cm of the bifurcation the pseudo-aneurysm will be usually be suitable for compression. The size of the sac must be measured in LS and TS, this is particularly important if the management results in thrombin injection as the radiologist will judge how much to use based on the size of the sac.

Suitability for compression depends on the position and width of the jet: the wider the jet the less likely it is going to successfully compressed. If the pseudo-aneurysm lies directly above the jet it will make it difficult to compress, the deeper the aneurysm i.e. if it originates off the posterior wall again it will be difficult to compress<sup>1,2,21,22</sup>.

The dimensions of the pseudo-aneurysm must be recorded – length, AP and ML<sup>21</sup>.

If no colourflow is seen filling a pseudo-aneurysm but there is evidence of fresh haematoma the report should state "no evidence of patent pseudo-aneurysm but areas of fresh haematoma noted, cannot exclude a thrombosed pseudo-aneurysm or slow bleed".

If the pseudo-aneurysm is deemed to be suitable for compression then it is necessary to arrange for the patient to come down on their bed. The patient may require analgesics as the compression can cause significant discomfort – the SHO/HO needs to supply and if necessary administer the pain relief.

Using the L7-5 probe, the vascular scientist needs to apply pressure over the jet of the pseudo-aneurysm and should attempt to occlude it. The first compression should last 10 minutes and the circulation should be checked with a hand held Doppler at the ankle to ensure patency. After 10 minutes the pseudo-aneurysm needs to be checked to see if it is thrombosed or partially thrombosed. If still patent further compressions of 10 minutes need to be performed, up to a maximum of three sessions. If after the third session the pseudo-aneurysm is still patent then the patient should be referred to interventional radiologist for thrombin injection.

If the pseudo-aneurysm has thrombosed then we need to rescan the patient the next day to ensure it remains occluded<sup>2,22,23</sup>.

## REFERENCES:

1. Thrush and Hartshorne. (2010). Vascular Ultrasound, How, Why and When. 3<sup>rd</sup> Edition.
2. Institute of Physics and Engineering in Medicine in association with The Society For Vascular Technology of GB & Ireland. (2001). Vascular Laboratory Practice Part VI, IPEM 1<sup>st</sup> Edition.
3. Zwiebel WJ, Pellerito JS. (2005) Introduction to vascular ultrasonography 5<sup>th</sup> edition. Elsevier Saunders, Philadelphia.
4. Philips. (2005). iu22 Ultrasound System. Getting Started handbook.
5. Hammets D. (2004). Vascular Technology. The Burwin Institute. USA.
6. Leiner T, Kessels A, Nelemans P, Vasbinder B, Haan M, Kitslaar P, Yiu K, Tordoir J, Engelshoven J. (2005) Peripheral Arterial Disease Comparison of Colour Duplex US and Contrast-enhanced MR Angiography for Diagnosis. Radiology; 235:699-708.
7. Eiberg J, Gronvall Rasmussen J, Hansen M, Schroder T. (2010). Duplex Ultrasound Scanning of Peripheral Arterial Disease of the Lower Limb. European Journal of Vascular Surgery. 40:507-512.
8. Geehard-Herman M, Gardin J, Jaff M, Mohler E, Roman M, Naqvi T. (2001). Guidelines for Non-invasive Vascular Laboratory Testing: A Report from the American Society of Echocardiography and the Society for Vascular Medicine and Biology. Vascular Medicine; 11:183-200.
9. Marks, N, Ascher E, Hingorani A. (2007). Treatment of Failing Lower Extremity Arterial Bypasses Under Ultrasound Guidance. Perspectives in Vascular Surgery and Endovascular Therapy;19:34-39.



10. Gerhard-Herman M. et al. (2006). Guidelines for noninvasive vascular laboratory testing: a report from the American Society of Echocardiography and the Society for Vascular Medicine and Biology.
11. Polak J. (1992). Peripheral Vascular Sonography. A Practical Guide.
12. William and Wilkins, Baltimore. Rossi F et al. (2006). Colour-flow Duplex Hemodynamic Assessment of Runoff in Ischaemic Lower Limb Revascularisation. The International Society for Vascular Surgery. *Vascular*; 14:149-155.
13. Szpinda M. (2005). Compensating Crural Anastomoses in Chronic Critical Limb Ischaemia. *Via Medica*; 64(1):17-21.
14. Schlager O. et al. (2007). Duplex Sonography Versus Angiography for Assessment of Femoropopliteal Arterial Disease in a 'Real-World' Setting. *J Endovasc Ther*. Aug;14(4):452-9.
15. Polak J. (2016). Institute for Advanced Medical Education. Evaluation of Lower Extremity Bypass Grafts. Published online at <https://iame.com/online-courses/ultrasound-vascular/evaluation-of-lower-extremity-bypass-grafts>
16. Moore J, Salles-Cunah S, Scissons R, Beebe H, Toledo. (2001). Diameter Comparison of Saphenous Vein Bypasses for Popliteal Aneurysm Versus Peripheral Arterial Occlusive Disease in Matched Subjects. *Vascular Surgery*;35(6):449-455.
17. Baril D, Marone L. (2012). Duplex Evaluation Following Femoropopliteal Angioplasty and Stenting: Criteria and Utility of Surveillance. *Vasc Endovascular Surg*. Jul;46(5):353-7.
18. Scissons R, (2002). Lower Extremity Duplex Graft Surveillance. *Journal of Vascular Technology* 200126(1)55-60.
19. Cassar N, Dunjic B, Cassar K. (2010). Implementation of a Graft Surveillance Programme for Infrainigunal Vascular Bypass Surgery. *Malta Medical Journal*; 22(3): 24-26.
20. Bandyk D, Chauvapun J. (2007). Duplex Ultrasound Surveillance Can Be Worthwhile After Arterial Intervention. *Perspectives in Vascular Surgery and Endovascular Therapy*; 19(4):354-359.
21. Luedde M, Krumsdorf U, Zehelein J, Ivandic B, Dengler T, Katus H, Tiefenbacher C. (2007). Treatment of Iatrogenic Femoral Pseudoaneurysm by Ultrasound-Guided Compression Therapy and Thrombin Injection. *Angiology*;58:435-439.
22. Yetkin U, Gurbuz A. (2003). Post-Traumatic Pseudoaneurysm of the Brachial Artery and Its Surgical Treatment. *Texas Heart Institute Journal*;30:293-297.
23. Latic A, Delibegovic, Pudic I, Samardzic, Radmilovic. (2011). Non-Invasive Ultrasound Guided Compression Repair of Post Puncture Femoral Pseudoaneurysm. *Med Arth*: 65(2):113-114.
24. Wright I, Buckenham T. (2003). Lower Limb Arterial Duplex Ultrasound Exam Protocol. Christchurch Public Hospital.
25. Society for Vascular Technology. (2012). Professional Standards Committee Chaperone Guidelines [www.svtgbi.org.uk](http://www.svtgbi.org.uk)
26. Society for Vascular Technology. (2015). Vascular Technology Professional Performance Guidelines. Lower Limb Arterial Duplex Ultrasound Examination. [www.svtgbi.org.uk/media/resources/LowerLimbArterialPSCFinalJuly2015edit.pdf](http://www.svtgbi.org.uk/media/resources/LowerLimbArterialPSCFinalJuly2015edit.pdf)



27. Cossmann D.V, Ellison, J.E, Wagner, W.H et al. (1989). Comparison of contrast arteriography to arterial mapping with colour-flow duplex imaging in the lower extremities. *Journal of Vascular Surgery* 20. 978-986.
28. Sensier Y, Hartshorne, T, Thrush, A et al. (1996). A prospective comparison of lower limb color-coded duplex scanning with arteriography. *European Journal of Vascular and Endovascular Surgery* 11: 170-175.
29. Hennerici M, Neuerburg-Heusler D. 1998. Vascular diagnosis with ultrasound. Thieme, Stuttgart, pp 179-180.

#### g) Popliteal artery entrapment syndrome (PAES)

PAES is a rare developmental defect in which the gastrocnemius muscle, popliteus muscle or tendons neighbouring the popliteal fossa are abnormally formed and can cause extrinsic compression of the popliteal artery when the lower limb is maintained in certain positions<sup>1,2</sup>. Currently five anatomical variants of popliteal entrapment have been identified and are summarised in the table below<sup>3</sup>. However, over-development of the gastrocnemius muscle can produce similar entrapment of the popliteal artery, this sixth form is known as functional popliteal entrapment syndrome and is often observed in professional athletes or in those whose profession require physical activity<sup>3,4,5</sup>.

Variant of PAES	Anatomical Abnormality
Type 1	Popliteal artery follows an abnormal course
Type 2	Medial head of gastrocnemius muscle lies in a lateral location impinging on popliteal artery that runs a normal course
Type 3	An accessory slip of gastrocnemius muscle impinges the popliteal artery that runs a normal course
Type 4	Popliteus muscle or fibrous band impinges the popliteal artery that runs a normal course
Type 5	Types 1- 4 and the popliteal vein is also entrapped

Anatomical variants of PAES<sup>3</sup>.

Patients with PAES commonly present with intermittent calf claudication and paresthesia symptoms which exacerbate upon exercise. Since the patient demographic of those suffering from PAES is typically young athletic individuals, the symptoms are often likely to be attributable to musculoskeletal disorders rather than vascular disease<sup>6</sup>. However, differential diagnoses can include a number of lower limb disorders such as peripheral vascular disease, cystic adventitial disease, arterio-venous fistulae, compartment syndrome, muscle rupture, neuropathy and venous thrombosis<sup>4,6</sup>. If left undiagnosed, prolonged exposure to PAES can result in micro-trauma to popliteal artery, and can ultimately lead to localised stenoses, aneurysms or complete occlusion<sup>3</sup>.



If PAES is suspected, current recommendations stipulate that stress positional assessment using spectral Doppler ultrasound and waveform analysis, when combined with Ankle Brachial Pressure Index measurements, can provide a rapid, non-invasive method for accurate diagnosis<sup>4,6</sup>.

**Note; approximately 50% of individuals experience popliteal entrapment in extreme plantar flexion and dorsiflexion positions<sup>7</sup>.**

### Scan protocol

A full bilateral arterial duplex should be performed, as per previous protocol, to rule out any significant arterial pathology that could be the direct cause or contributing towards any symptoms. Care should be taken to note any focal stenosis or aneurysms of the popliteal arteries as prolonged vascular microtrauma at an impingement site can be a contributing factor towards such pathology<sup>3</sup>. If PAES is diagnosed it is likely to be at this level<sup>3</sup>.

Ankle Brachial Pressure Indices should be taken pre and post exercise as any enlargement of the gastrocnemius muscle post exercise can contribute towards popliteal entrapment, ultimately leading to a significant impingement of the popliteal artery and a related post stenotic pressure drop.

### PAES assessment;

The patient should lie prone on an examination couch with both legs, from mid-calf level, extended past the edge of the couch<sup>8</sup>. Both popliteal arteries are assessed along their length in B-Mode, in both transverse and longitudinal planes, whilst the patient moves the feet into dorsiflexion and plantar flexion positions. If any compression is observed the location should be noted in relation the knee crease as this will aid the CVS when assessing the region further (compression will usually be at the level of the gastrocnemius muscle heads<sup>8</sup>).

Both popliteal arteries should be assessed along their length using colourflow, whilst the patient moves the feet into dorsiflexion and plantar flexion positions. If a narrowing is observed spectral Doppler measurements should be taken in both relaxed and flexed positions at the level of the impingement site. Care should be taken to adjust colourflow settings so that the region of highest velocity is sampled. It may be necessary to provide resistance in a prone position in order to reach full dorsi-flexion and plantar flexion range and therefore a second CVS or healthcare assistant may be needed in order to aid with diagnosis<sup>8</sup>.

### REFERENCES

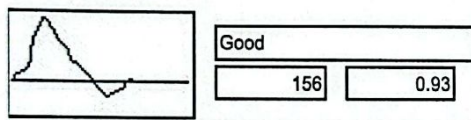
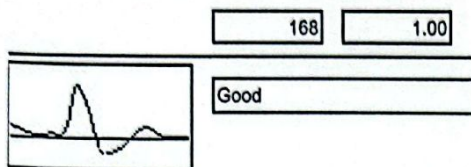
1. Elias, D.A., White, L.M., Rubenstein, J.D., Christakis, M., Merchant, N. 2003. Clinical evaluation and MR imaging features of popliteal artery entrapment and cystic adventitial disease. American Journal of Roentgenology. 180(3), pp.627-632.



2. Gourgiotis, S., Aggelakas, J., Salemis, N., Elias, C., Georgiou, C. 2008. Diagnosis and surgical approach of popliteal artery entrapment syndrome: a retrospective study. *Vascular health and risk management*. 4(1), pp83-86.
3. Wright, L.B., Matchett, W.J., Cruz, C.P., James, C.A., Culp, W.C., Eidt, J.F., McCowan, T.C. 2004. Popliteal artery disease: diagnosis and treatment. *Radiographics*. 24(2), pp.467-479.
4. Roche-Nagle, G., Wong, K.T., Oreopoulos, G. 2009. Vascular claudication in a young patient: popliteal entrapment syndrome. *Hong Kong medical journal*. 15(5), pp.388-390.
5. Soobrah, R., Nawaz, A., Hussain, T. 2010. Popliteal artery entrapment syndrome presenting with acute limb ischaemia: a case report. *Case reports in medicine*. 2010(281925), pp.1-3
6. Lamb, C.M., Davies, C.G., Whitbread, T. 2010. Two Cases of Misdiagnosed Popliteal Artery Entrapment Syndrome. *European Society for Vascular Surgery*. 20, pp.e16-e18.
7. Levien, L.J., Veller, M.G. 1999. Popliteal artery entrapment syndrome: more common than previously recognized. *Journal of vascular surgery*. 30(4), pp.587-598
8. Thrush, A., Hartshorne, T. 2010. *Vascular ultrasound: How, Why and When*. 3<sup>rd</sup> ed. Churchill Livingstone. Elsevier.

Reason Claudication  
Outcome Occlusion

### Right



Brachial

Common Femoral

High Thigh

Low Thigh

Popliteal

High Calf

Peroneal

Anterior Tibial

Posterior Tibial

Dorsalis Pedis

Toe Pressure

Post Exercise

### Left

Reduced



Reduced



Reduced



Reduced



Reduced

74 0.44



### Notes

#### LEFT LOWER LIMB ARTERIAL DUPLEX

AORTA: Mild disease with calcified walls, good triphasic waveforms, PSV 81cm/s. No evidence of aneurysm or focal dilation with maximum dimensions ITI = 1.2cm, OTO = 1.4cm.

#### LEFT

CIA: Mild disease with calcified walls in the prox to mid vessel, high resistant triphasic waveforms, PSV

Assessed by Emily Davies, MCVS

Printed on 26/07/2024 at 9:39 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



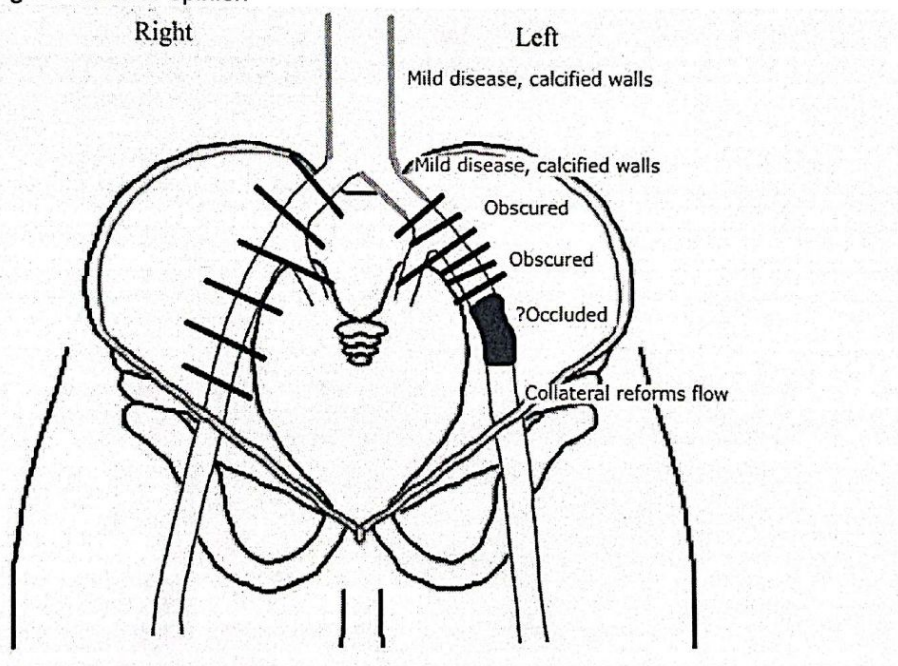
51cm/s. Distal vessel obscured due to bowel gas ?occluded distally  
 EIA: Prox to mid vessel was difficult to visualise due to bowel gas with no flow seen ?occluded. Flow appears to reform in the very distal vessel via large collateral.  
 CFA: Mild disease, reduced monophasic waveforms, PSV 32cm/s.  
 PFA origin: Mild disease, reduced monophasic waveforms, PSV 69cm/s.  
 SFA: Mild disease, reduced monophasic waveforms, PSV 47-61cm/s.  
 PopA: Patent, reduced monophasic waveforms, PSV 30-31cm/s.  
 TPT is patent. 3 run-off origins noted.  
 ATA: Difficult to visualise the prox to mid vessel due to small calibre, however, appears patent where seen.  
 Mild disease with calcified walls at ankle, reduced monophasic waveforms, PSV 18cm/s.  
 PTA: Mild disease with calcified walls, reduced monophasic waveforms, PSV 22cm/s.  
 PEROA: Mild disease with calcified walls, reduced monophasic waveforms, PSV 14cm/s.

#### LEFT

CFA: Mild disease, good triphasic waveforms, PSV 133cm/s.  
 PTA: Good biphasic waveforms with HHD

Right resting ABPI is within normal limits (Right - 0.93)  
 Left resting ABPI is reduced (Left - 0.44)

Suggest alternative imaging if appropriate  
 Suggest urgent surgical vascular opinion

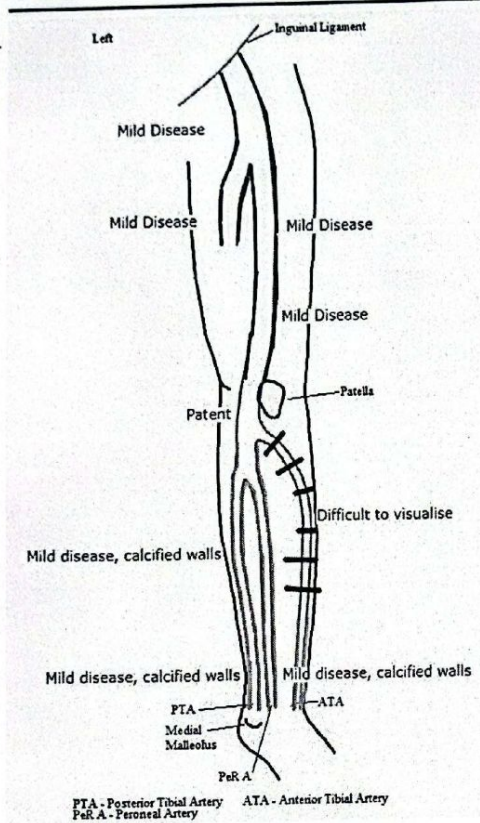


Assessed by Emily Davies, MCVS

Printed on 26/07/2024 at 9:39 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Assessed by

Emily Davies, MCVS

Printed on 26/07/2024 at 9:39 am

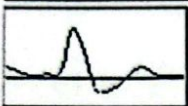
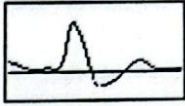
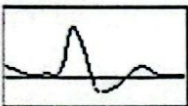
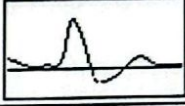
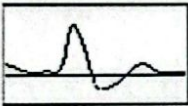

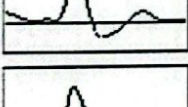
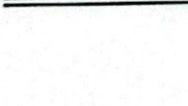
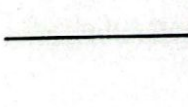
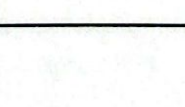
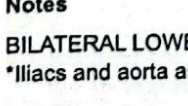

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



<b>Reason</b>	Routine	
<b>Outcome</b>	Normal	

Right		Left
 <div>130 1.00</div> <div>Good</div>	Brachial	
 <div>Good</div>	Common Femoral	
	High Thigh	
 <div>Good</div>	Low Thigh	
	Popliteal	
 <div>Good</div>	High Calf	
 <div>Good</div>	Peroneal	
 <div>Good 142 1.09</div>	Anterior Tibial	
 <div>Good</div>	Posterior Tibial	 <div>138 1.06</div>
	Dorsalis Pedis	
	Toe Pressure	
	Post Exercise	

#### Notes

**BILATERAL LOWER LIMB ARTERIAL DUPLEX**  
 \*Iliacs and aorta assessed due to patient symptoms

**AORTA:** Mild disease, good triphasic waveforms, PSV 88cm/s. No evidence of aneurysm identified where seen, max dimensions TS =1.6cm ITI.

#### RIGHT

Assessed by Emily Davies, MCVS

Printed on 16/07/2024 at 8:39 am

Checked by

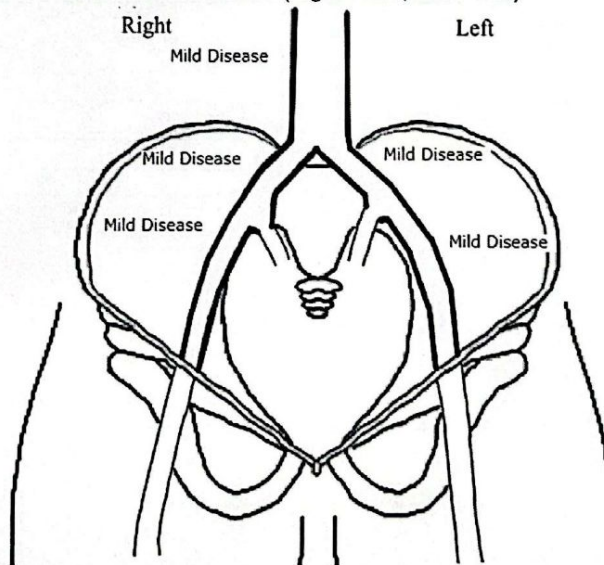
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

CIA: Mild disease, good triphasic waveforms, PSV 84cm/s.  
EIA: Mild disease, good triphasic waveforms, PSV 142cm/s.  
CFA: Mild disease, good triphasic waveforms, PSV 150cm/s.  
PFA origin: Mild disease, good triphasic waveforms, PSV 93cm/s.  
SFA: Mild disease, good triphasic waveforms, PSV 117-121cm/s.  
PopA: Mild disease, good triphasic waveforms, PSV 57-66cm/s.  
TPT is patent. 3 run-off origins noted.  
ATA: Mild disease, good tri/biphasic waveforms, PSV 137cm/s.  
PTA: Mild disease, good triphasic waveforms, PSV 60cm/s.  
PEROA: Mild disease, good triphasic waveforms, PSV 53cm/s.

#### LEFT

CIA: Mild disease, good triphasic waveforms, PSV 107cm/s.  
EIA: Mild disease, good triphasic waveforms, PSV 147cm/s.  
CFA: Mild disease, good triphasic waveforms, PSV 81cm/s.  
PFA origin: Mild disease, good triphasic waveforms, PSV 89cm/s.  
SFA: Mild disease, good triphasic waveforms, PSV 77-104cm/s.  
PopA: Mild disease, good triphasic waveforms, PSV 61-67cm/s.  
TPT is patent. 3 run-off origins noted.  
ATA: Mild disease, good tri/biphasic waveforms, PSV 38cm/s.  
PTA: Mild disease, good triphasic waveforms, PSV 85cm/s.

Bilateral resting ABPI's are within normal limits (Right - 1.09, Left - 1.06)



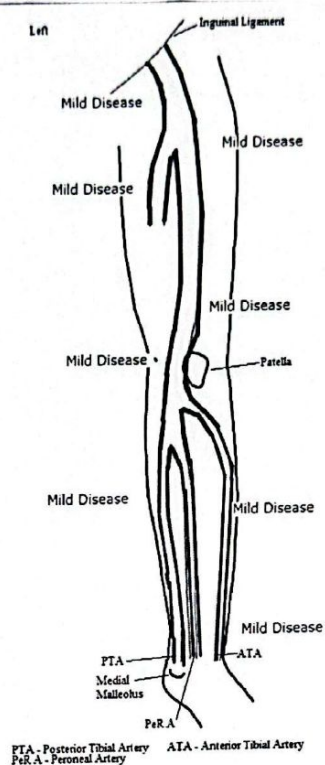
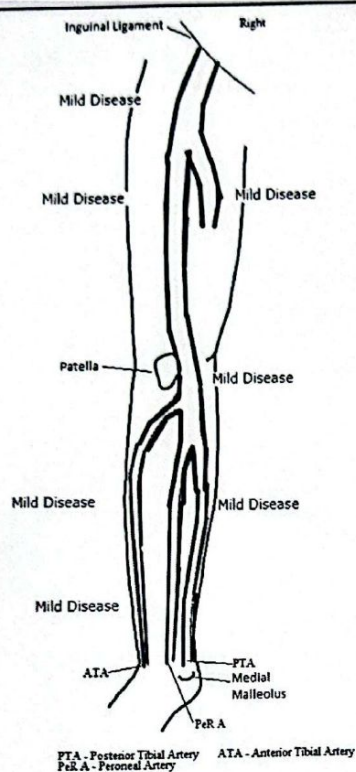
Assessed by Emily Davies, MCVS

Printed on 16/07/2024 at 8:39 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.





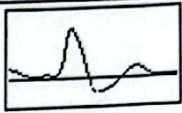
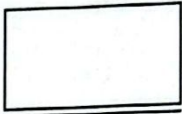
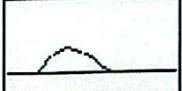
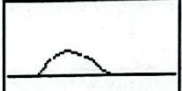
Assessed by Emily Davies, MCVS

Printed on 16/07/2024 at 8:39 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason                      Ulceration  
Outcome                    Occlusion, Calcified

Right		Left
	Brachial	
	Common Femoral	Good 
	High Thigh	
	Low Thigh	
	Popliteal	Absent 
	High Calf	
	Peroneal	
	Anterior Tibial	Reduced 
	Posterior Tibial	Reduced 
	Dorsalis Pedis	
	Toe Pressure	
	Post Exercise	

**Notes**

**LEFT LOWER LIMB ARTERIAL DUPLEX**

\*Challenging examination due to oedema, patient habitus and patient limited mobility - patient scanned in chair

**LEFT**

CFA: Mild/ moderate disease with calcified walls, good triphasic waveforms, PSV 77cm/s.

PFA origin: Obscured due to depth/ acoustic shadowing from calcified disease

Assessed by                      Emily Davies, MCVS

Printed on 10/07/2024 at 11:53 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



SFA: Mild/ moderate disease with calcified walls along length. Good triphasic waveforms identified proximally, PSV 114cm/s. Slightly reduced monophasic waveforms identified in the mid to distal vessel, PSV 31-47cm/s.

PopA: Patent proximally, damped bouncy monophasic waveforms, PSV 75cm/s. Large collateral noted in mid vessel. Vessel appears to occlude distally (36cm prox MM). No flow identified.

TPT obscured due to depth ?Patency

ATA: Prox to mid vessel obscured due to depth and extensive oedema. Patent distally, reduced monophasic waveforms, PSV 19cm/s.

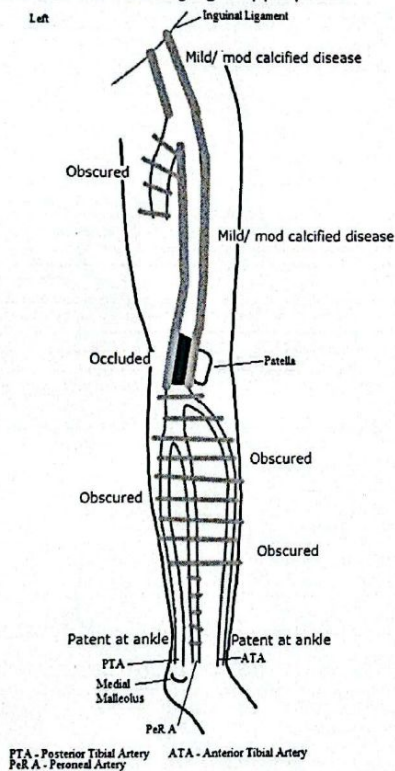
PTA: Prox to mid vessel obscured due to depth and extensive oedema. Patent distally, reduced monophasic waveforms, PSV 31cm/s.

PEROA: Obscured due to depth and oedema

Resting ABPI's not performed due to patient being scanned in chair

Suggest vascular surgical opinion

Suggest alternative imaging if appropriate



Assessed by Emily Davies, MCVS

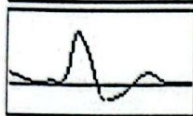
Printed on 10/07/2024 at 11:53 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason Graft synthetic, Graft vein  
Outcome Patent

Right



Good

Brachial

Common Femoral

High Thigh

Low Thigh

Popliteal

High Calf

Peroneal

Anterior Tibial

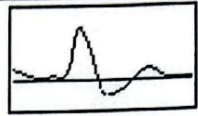
Posterior Tibial

Dorsalis Pedis

Toe Pressure

Post Exercise

Left



Good

Notes

RIGHT ILIO-FEM GRAFT + FEM-FEM GRAFT + Lt FEM-TPT BYPASS DUPLEX ASSESSMENT  
\*Rt BKA.

AO - Poor views due to bowel gas/tense abdomen.

RIGHT ILIO-FEM GRAFT  
CIA - Poor views due to bowel gas/ tense abdomen.

Assessed by Emily Davies, MCVS

Printed on 26/07/2024 at 10:43 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



PROX ANAST (distal CIA) - Patent, good triphasic waveforms, PSV 232cm/s.  
MID GRAFT - Patent, good biphasic waveforms, PSV 173-238cm/s.  
DIST ANAST - Patent, good triphasic waveforms, PSV 228cm/s.  
CFA: Patent, good triphasic waveforms, PSV 244cm/s.

**FEM-FEM CROSSOVER (Rt to Lt)**

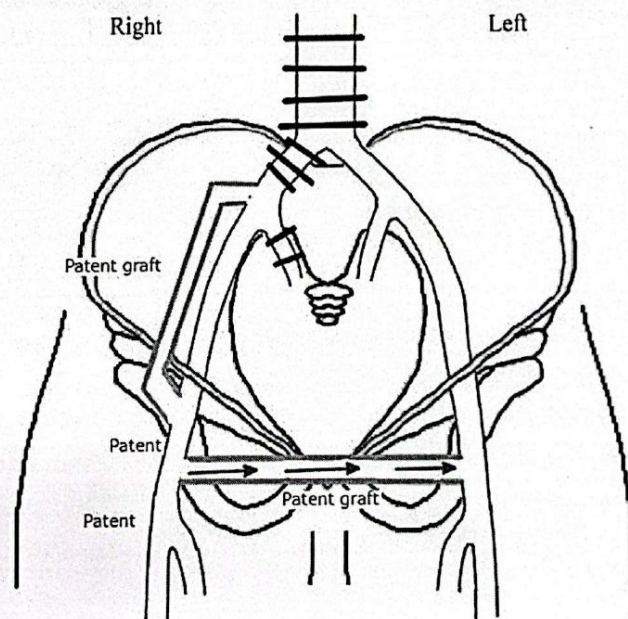
Prox ANAST - Patent good triphasic waveforms, PSV 252cm/s.  
Graft Body: Patent, good biphasic waveforms, PSV 147-203cm/s.  
Dist ANAST - Patent, good biphasic waveforms, PSV 147cm/s.

**Lt FEM-TPT BYPASS**

Prox ANAST - Patent, good bouncy monophasic waveforms, PSV 138cm/s.  
Prox graft - Patent, good biphasic waveforms, PSV 98cm/s.  
Mid graft - Patent, good biphasic waveforms, PSV 74cm/s.  
Dist graft - Patent, slightly reduced monophasic waveforms, PSV 36cm/s \*(Velocities <45cm/s indicative of graft failure).  
Dist ANAST - Patent, slightly reduced monophasic waveforms, PSV 48cm/s.

Unable to assess calf vessels due to compression bandages

ABPIs not performed due to compression dressings

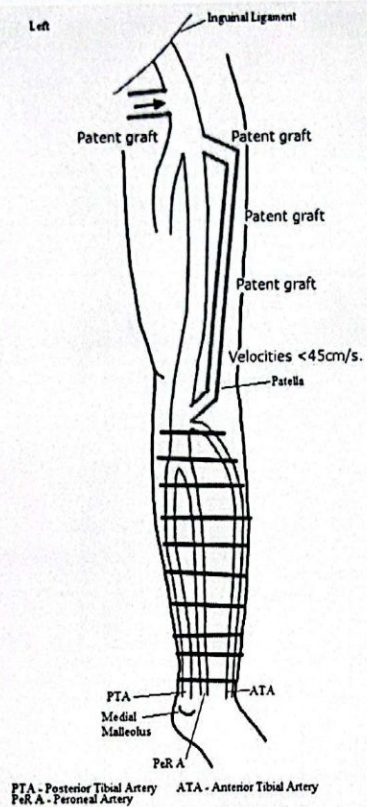


Assessed by Emily Davies, MCVS

Printed on 26/07/2024 at 10:43 am

Checked by \_\_\_\_\_

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Assessed by Emily Davies, MCVS




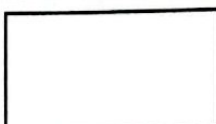
Printed on 26/07/2024 at 10:43 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Reason Graft vein fem-pop  
Outcome Patent

Right		Left
	Brachial	
	Common Femoral	Good 
	High Thigh	
	Low Thigh	
	Popliteal	Good 
	High Calf	
	Peroneal	
	Anterior Tibial	Good 
	Posterior Tibial	Absent 
	Dorsalis Pedis	
	Toe Pressure	
	Post Exercise	

#### Notes

DUPLEX ASSESSMENT LEFT FEM-POP BYPASS (vein)

CFA: Mild/ moderate disease, good triphasic waveforms, PSV 167cm/s.

PFA: Mild/ moderate disease, good triphasic waveforms, PSV 154cm/s.

SFA: Prox to mid vessel, mild/ moderate disease, good triphasic waveforms, PSV 105-177cm/s.

PROX ANAST: Patent, good bouncy monophasic waveforms, PSV 47cm/s.

Assessed by Emily Davies, MCVS

Printed on 26/07/2024 at 10:10 am

Checked by

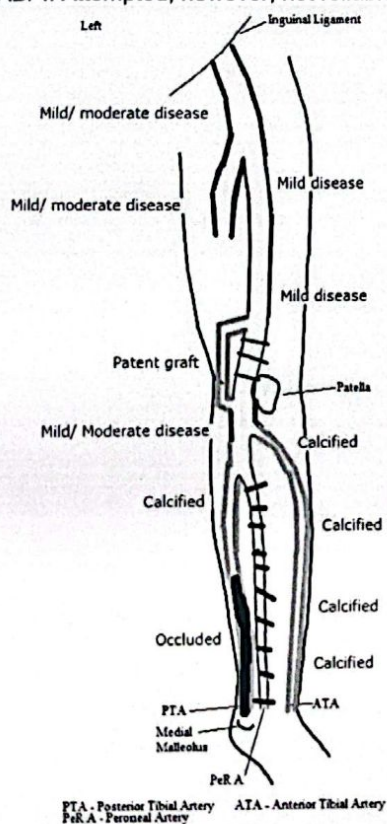
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

MAIN BODY: Patent, good bouncy monophasic waveforms, PSV 58-86cm/s.  
DIST ANAST: Patent, good bouncy monophasic waveforms, PSV 75cm/s.

PopA: Mild/ moderate disease, good bouncy monophasic waveforms, PSV 78-87cm/s.

ATA: Heavily calcified and difficult to visualise, good bouncy monophasic waveforms at ankle, PSV 97cm/s.  
PTA: Heavily calcified and difficult to visualise in the prox to mid vessel, however, good bouncy monophasic waveforms identified where seen, PSV 58cm/s. No flow identified in the distal vessel from 14cm prox MM.  
PerA: Not identified due to oedema

ABPI: Attempted, however, not reliable due to excessive oedema



Assessed by Emily Davies, MCVS

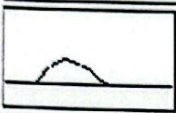
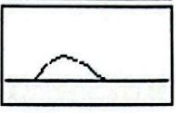
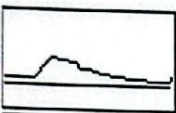
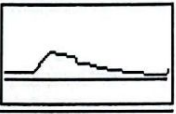
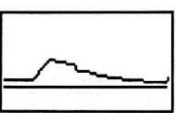
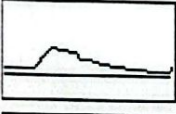
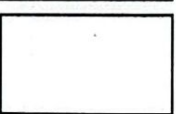
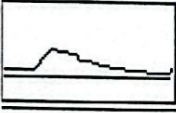
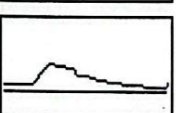
Printed on 26/07/2024 at 10:10 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Reason Post-op  
Outcome Dissection, Stenosis moderate, Occlusion, Calcified

Right	Left
182 1.00	
 Reduced	Common Femoral  Reduced
	High Thigh
	Low Thigh
 Weak	Popliteal  Weak
	High Calf
	Peroneal  Weak
 Weak	Anterior Tibial  Absent
 Weak 102 0.56	Posterior Tibial  Weak 116 0.64
	Dorsalis Pedis
	Toe Pressure
	Post Exercise

#### Notes

#### LEFT LOWER LIMB ARTERIAL DUPLEX ASSESSMENT

\*Challenging scan due to bowel gas

AORTA: Mild/mod calcified disease, unable to obtain waveform due to interfering bowel gas and low velocity flow. Vessel appears a normal uniform calibre, TS 1.4cm.

#### RIGHT

Assessed by Emily Davies, MCVS

Printed on 09/07/2024 at 3:43 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

CIA: Difficult to visualise due to bowel gas, however, hyperechoic linear structure identified in the prox/mid vessel ?dissection. Mild disease with calcified walls, reduced monophasic waveforms, PSV 23cm/s.  
EIA: Prox to mid vessel obscured due to bowel gas. Occlusive mixed plaque identified in the distal vessel. No flow identified.  
CFA: Flow reforms in the mid vessel, moderate disease with calcified walls, reduced monophasic waveforms, PSV 29cm/s.  
PFA: Appears moderately stenosed with a velocity increase from PSV 29 to 113cm/s.  
Prox SFA: Mild/ moderate disease with calcified walls, weak monophasic waveforms, PSV 11cm/s.  
POPA: Mild/ moderate disease with calcified walls, weak monophasic waveforms, PSV 10-11cm/s.  
ATA: Patent with calcified walls, weak monophasic waveforms, PSV 6cm/s.  
PTA: Patent with calcified walls, weak monophasic waveforms, PSV 8cm/s.

#### LEFT

CIA: Poorly visualised due to bowel gas and calcification however where seen the vessel/ stent appears occluded.  
EIA: Prox vessel was obscured due to bowel gas. Distal vessel appears patent with mild/mod calcified disease, reduced monophasic waveforms, PSV 18cm/s.  
CFA: Mild/mod calcified disease, reduced monophasic waveforms, PSV 19cm/s.

#### FEM-POPA GRAFT

PROX ANAST: Patent with reduced monophasic waveforms, PSV 21cm/s. \*velocities of less than 45 cm/s may be indicative of future graft failure.  
GRAFT BODY: Patent with reduced monophasic waveforms, PSV 15-25cm/s. \*velocities of less than 45 cm/s may be indicative of future graft failure.  
DIST ANAST: Patent with reduced monophasic waveforms, PSV 8cm/s.

POPA: Mild/mod calcified disease, weak monophasic waveforms, PSV 14-20cm/s.  
ATA: Proximally the vessel is mildly disease with calcified walls, weak monophasic waveforms, PSV 15cm/s. Vessel occludes 23cm prox MM. Flow flow identified at ankle.  
PTA: Patent with calcified walls, weak monophasic waveforms, PSV 14cm/s.  
PEROA: Patent with calcified walls, weak monophasic waveforms, PSV 16cm/s.

Bilateral resting ABPI's are reduced (Right - 0.56, Left - 0.64) ?accuracy due to calcified disease

---

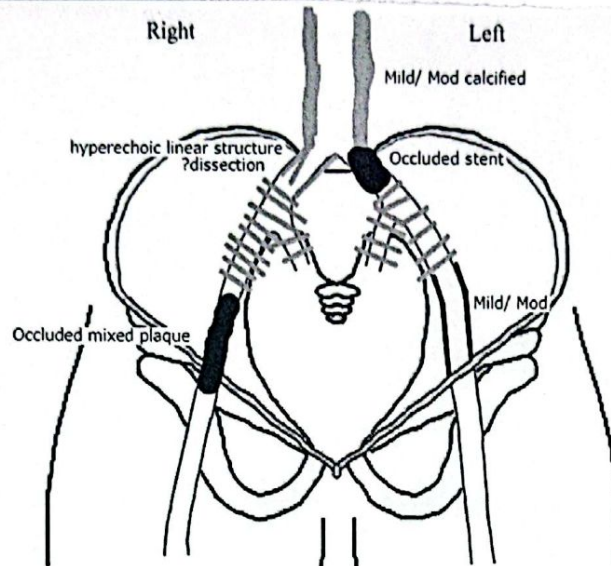
Assessed by Emily Davies, MCVS

Printed on 09/07/2024 at 3:43 pm

Checked by \_\_\_\_\_

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



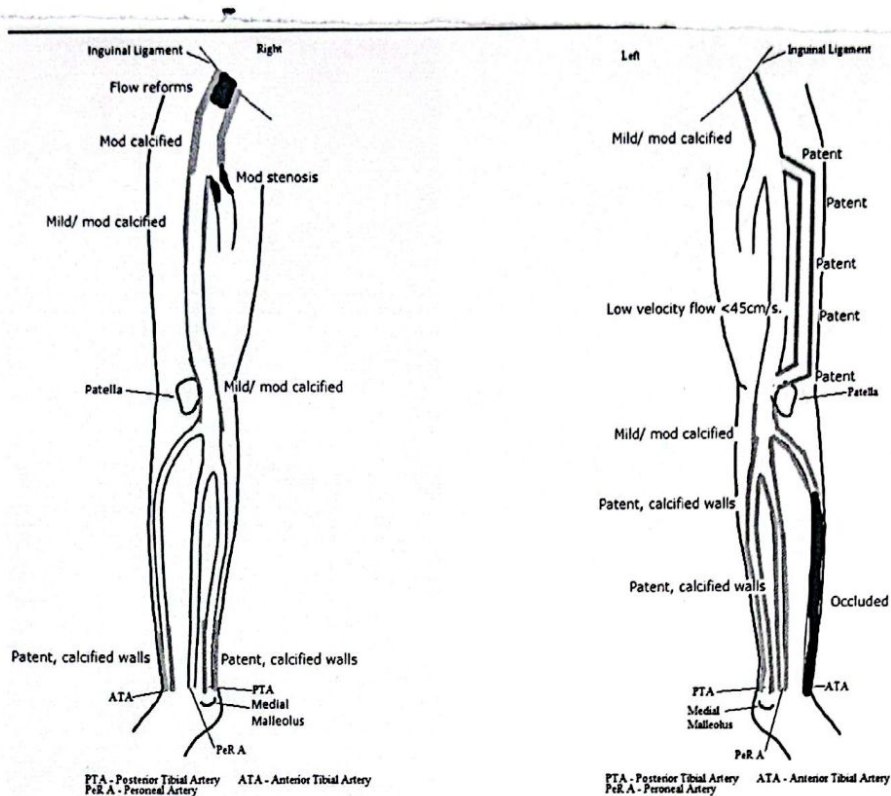


Assessed by Emily Davies, MCVS

Printed on 09/07/2024 at 3:43 pm

Checked by \_\_\_\_\_

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Assessed by Emily Davies, MCVS

Printed on 09/07/2024 at 3:43 pm

Checked by

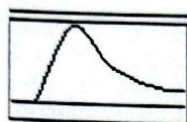
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Reason Ulceration  
Outcome Occlusion, Obscured, Calcified

Right

Left

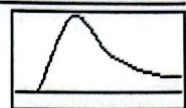


Turbulent

Brachial

Common Femoral

Turbulent

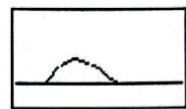


High Thigh

Low Thigh

Popliteal

Reduced



High Calf

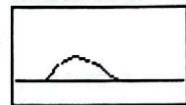
Peroneal

Weak



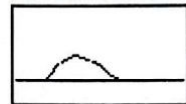
Anterior Tibial

Reduced



Posterior Tibial

Reduced



Dorsalis Pedis

Toe Pressure

Post Exercise

### Notes

#### LEFT LOWER LIMB ARTERIAL DUPLEX

AORTA: Difficult to visualise due to tense abdomen, bowel gas and calcified walls. Good triphasic waveforms identified where seen, PSV 54cm/s. Aorta appears ectatic with maximum measurements LS= 1.8cm ITI, 2.0cm OTO

#### LEFT

Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 1:51 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

CIA: Obscured due to bowel gas

EIA: The prox to mid vessel was obscured due to bowel gas. Raised velocities identified just distal to obscured region, PSV 410cm/s ?obscured significant disease

CFA: Mod/ severe disease identified with calcified walls, turbulent monophasic waveforms, PSV 218cm/s.

PFA origin: Mod/ severe disease identified with calcified walls, turbulent monophasic waveforms, PSV 230cm/s.

SFA: Vessel is chronically occluded from origin. No flow identified along vessel length.

PopA: Flow appears to reform in the prox vessel (40cm prox LM), mild/ moderate disease, reduced monophasic waveforms, PSV 45-64cm/s.

TPT was obscured due to oedema and calcified disease.

ATA: Intermittent flow noted along length due to heavily calcified vessel walls, reduced monophasic waveforms identified at ankle, PSV 20cm/s.

PTA: Intermittent flow noted along length due to heavily calcified vessel walls, reduced monophasic waveforms identified at ankle, PSV 33cm/s.

PEROA: Intermittent flow noted along length due to heavily calcified vessel walls, weak monophasic waveforms identified at ankle, PSV 20cm/s.

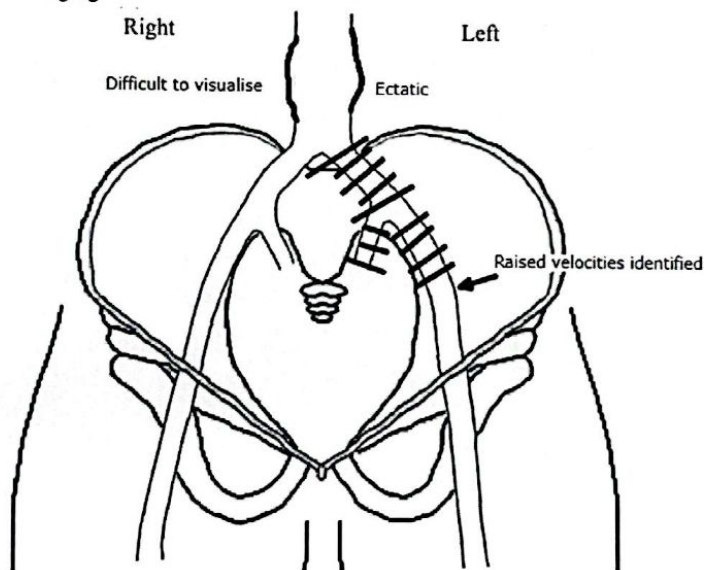
#### RIGHT

CFA: Turbulent monophasic waveforms, PSV 177cm/s.

PTA: Reduced monophasic waveforms, PSV 52cm/s.

Left resting ABPI was attempted, however, brachial pressure >220mmHg. Irregular heart rate/ poor signal made an ankle pressure unobtainable

Suggest alternative imaging



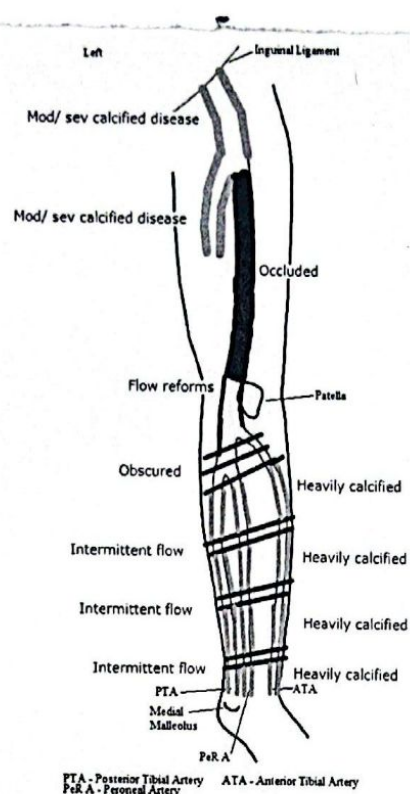
Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 1:51 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.





Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 1:51 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason	Routine
Outcome	Occlusion

Right

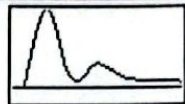
140	1.00
-----	------

Left

Brachial

Common Femoral

Good

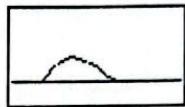


High Thigh

Low Thigh

Popliteal

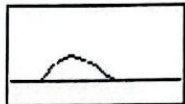
Reduced



High Calf

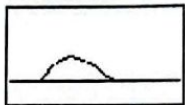
Peroneal

Reduced



Anterior Tibial

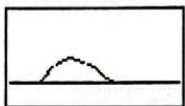
Reduced



Posterior Tibial

Reduced

104	0.74
-----	------



Dorsalis Pedis

Toe Pressure

Post Exercise

### Notes

#### LEFT LOWER LIMB ARTERIAL DUPLEX

AORTA: Mild disease, good triphasic waveforms, PSV 98cm/s. No evidence of aneurysm identified.

#### LEFT

CIA: Mild disease, good triphasic waveforms, PSV 128cm/s.

EIA: Mild disease, good triphasic waveforms, PSV 103cm/s.

Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 2:02 pm

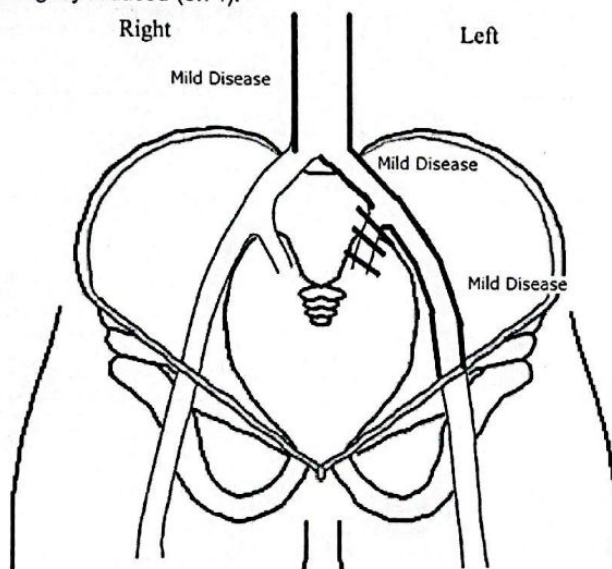
Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



CFA: Patent, mild calcified disease with good bouncy monophasic waveforms, PSV 132cm/s.  
PFA origin: Patent, mild disease, good bouncy monophasic waveforms, PSV 127cm/s.  
SFA: Patent proximally with mild calcified disease, good biphasic waveforms, PSV 92cm/s. Short occlusion noted mid thigh (63cm to 58cm from MM). Distal vessel appears patent with mild calcified disease, reduced monophasic waveforms, PSV 40cm/s. Patent through adductor canal.  
PopA: Patent, mild calcified disease with reduced monophasic waveforms, PSV 49-51cm/s.  
TPT is patent. 3 run-off origins noted.  
ATA: Patent proximally with weak monophasic waveforms. Mid vessel appears occluded (18 - 10cm prox MM). Flow reforms distally with some retrograde flow noted, patent at ankle with reduced retromonophasic waveforms, PSV 31cm/s.  
PTA: Patent along length, reduced monophasic waveforms at the ankle, PSV 24cm/s.  
PEROA: Patent, reduced monophasic waveforms at the ankle, PSV 42cm/s.

Left resting ABPI is slightly reduced (0.74).

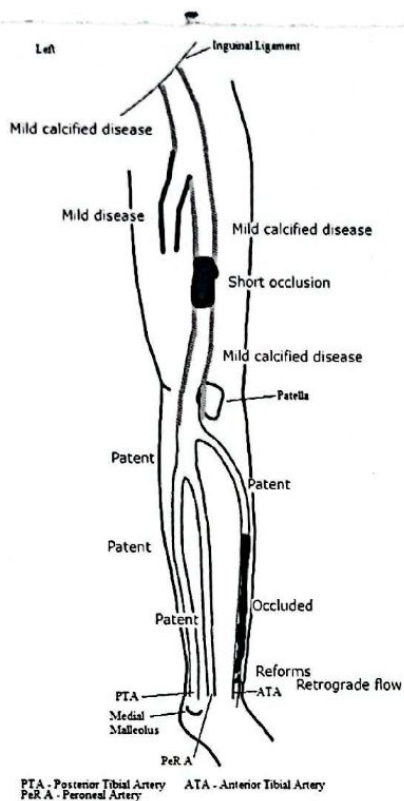


Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 2:02 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 2:02 pm

Checked by

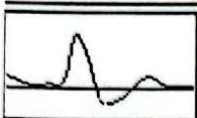
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



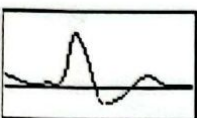
Reason Claudication  
Outcome Stenosis moderate, Stenosis severe

### Right

128 1.00



Good



Good



Good

132 1.03



Good

### Brachial

### Common Femoral

### High Thigh

### Low Thigh

### Popliteal

### High Calf

### Peroneal

### Anterior Tibial

### Posterior Tibial

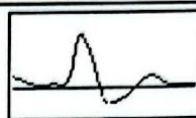
### Dorsalis Pedis

### Toe Pressure

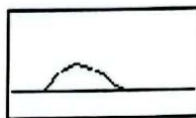
### Post Exercise

### Left

Good

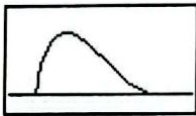


Reduced

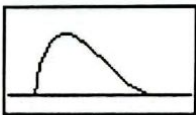


Slightly Reduced

98 0.77



Slightly Reduced



Foot Flex

132 1.03

Foot Flex

82 0.64

### Notes

### BILATERAL LOWER LIMB ARTERIAL DUPLEX

### RIGHT

CFA: Good triphasic waveforms

PopA: Good triphasic waveforms

ATA: Good bouncy monophasic waveforms at ankle

PTA: Good bouncy monophasic waveforms at ankle

Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:41 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

## LEFT

CFA: Mild disease, good triphasic waveforms, PSV 156cm/s.

PFA origin: Mild disease, good triphasic waveforms, PSV 151cm/s.

SFA: Mild disease proximally, good monophasic waveforms, PSV 76cm/s. Moderate stenosis identified in the mid vessel (55cm prox MM) with a velocity increase from PSV 49 to 148cm/s. Stenosis length ~0.67cm. Severe stenosis identified in the mid vessel (52cm prox MM) with a velocity increase from PSV 27 to 359cm/s. Distal vessel difficult to visualise due to depth, however, appears patent, reduced monophasic waveforms, PSV 30cm/s.

PopA: Mild disease, reduced monophasic waveforms, PSV 46-52cm/s.

TPT is patent. 3 run-off origins noted.

ATA: Patent, slightly reduced bouncy monophasic waveforms, PSV 94cm/s.

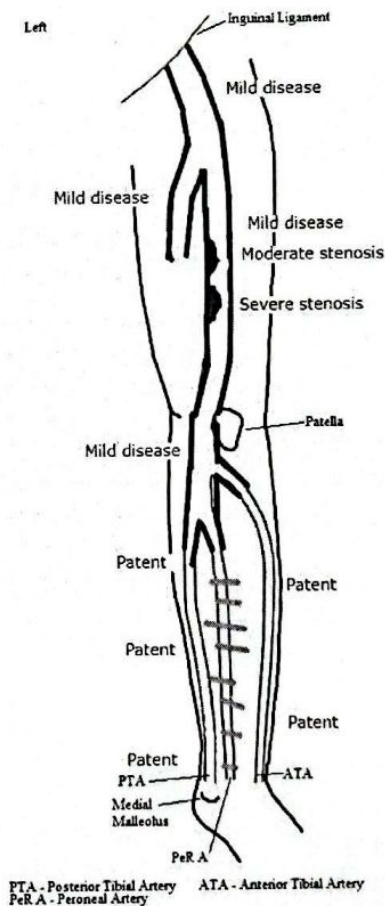
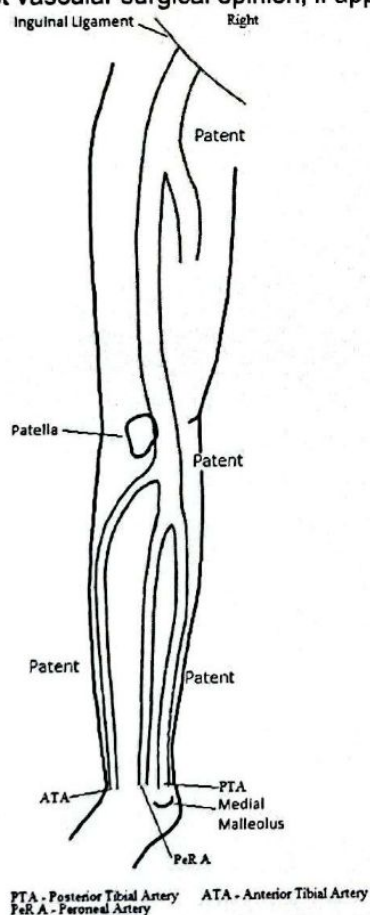
PTA: Patent, slightly reduced bouncy monophasic waveforms, PSV 55cm/s.

PEROA: Obscured due to depth

Right resting ABPI is within normal limits (Right - 1.03) with no reduction in systolic ankle pressure following a 1-minute foot flex exercise challenge.

Left resting ABPI is reduced (Left - 0.77) and reduced further after a one-minute exercise test

Suggest vascular surgical opinion, if appropriate



Assessed by Emily Davies, MCVS

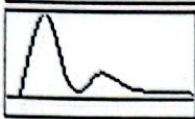
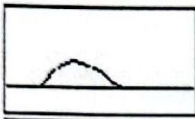

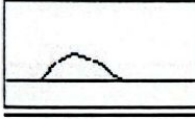
Printed on 08/07/2024 at 3:41 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Reason Claudication  
Outcome Stenosis severe, Obscured

Right		Left
	178 1.00 Turbulent	Brachial
	Reduced	Common Femoral
		High Thigh
		Low Thigh
		Popliteal
	Weak	High Calf
	Reduced 84 0.47	Peroneal
		Anterior Tibial
		Posterior Tibial
		Dorsalis Pedis
		Toe Pressure
		Post Exercise

#### Notes

##### RIGHT LOWER LIMB ARTERIAL DUPLEX

AORTA: Obscured due to depth, bowel gas and patient habitus

##### RIGHT

CIA: Obscured due to depth, bowel gas and patient habitus

EIA: Prox to mid vessel obscured due to depth, bowel gas and patient habitus. Distal vessel difficult to

Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:10 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

visualise due to depth, turbulence identified in the distal vessel due to a large collateral, turbulent bouncy monophasic waveforms, PSV 308cm/s.

CFA: Moderate disease, turbulent bouncy monophasic waveforms, PSV 228cm/s.

PFA origin: Moderate disease, turbulent bouncy monophasic waveforms, PSV 150cm/s.

SFA: Prox to mid vessel is patent with moderate disease, slightly reduced monophasic waveforms, PSV 45-125cm/s. Severe stenosis identified in the distal thigh (59cm) with a velocity increase from PSV 21 to 262cm/s. Stenosis length ~0.53cm. Distal to this the vessel was difficult to visualise due to depth ?obscured disease

PopA: Difficult to assess due to patient pain behind the knee. Mild/ moderate disease where seen, reduced monophasic waveforms, PSV 57-59cm/s.

TPT obscured due to depth.

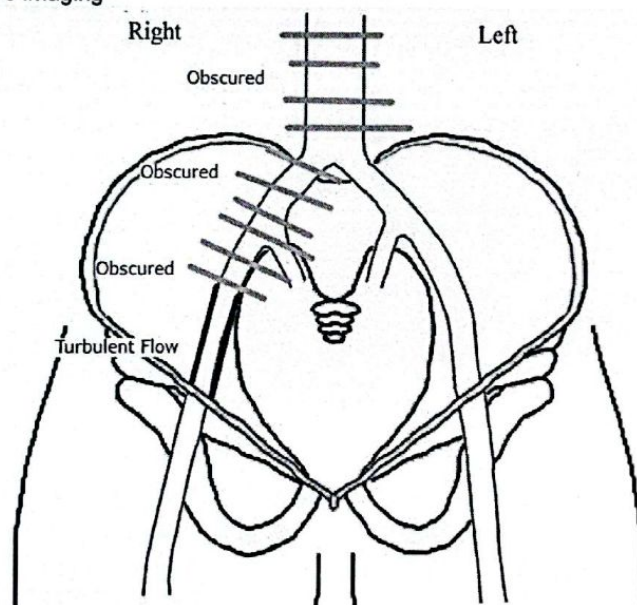
ATA: Prox to mid vessel difficult to visualise due to depth and oedema. Vessel patent at ankle, weak monophasic waveforms, PSV 16cm/s.

PTA: Patent along length, reduced monophasic waveforms, PSV 32cm/s.

PEROA: Obscured due to depth and oedema

Right resting ABPI is reduced (Right - 0.47)

Suggest alternative imaging



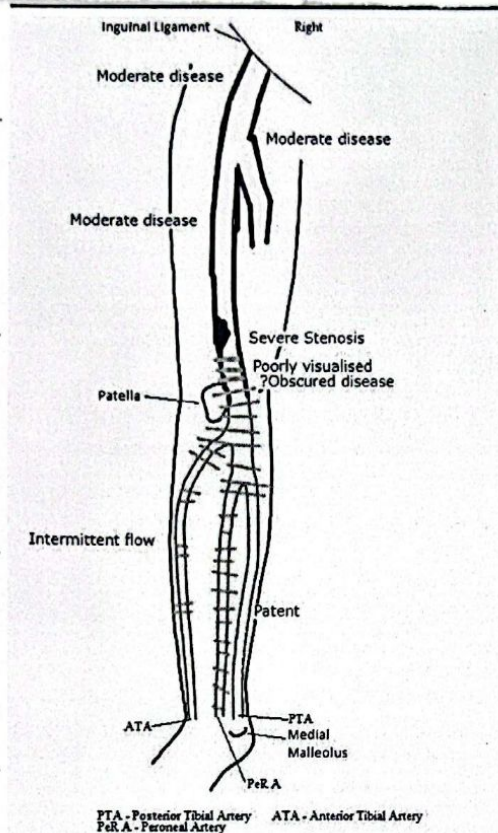
Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:10 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.





Assessed by Emily Davies, MCVS

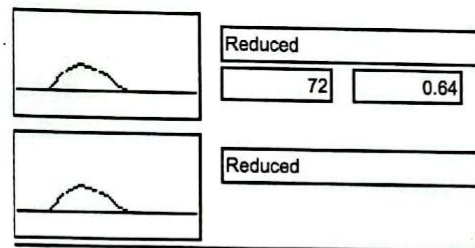
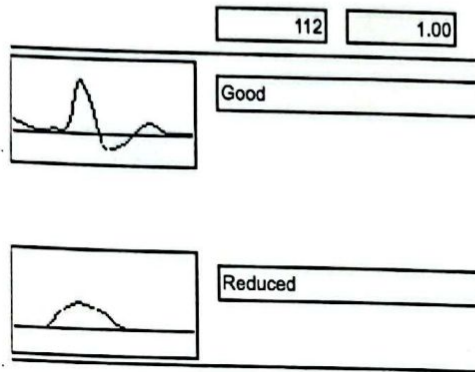
Printed on 08/07/2024 at 3:10 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason Routine  
Outcome Occlusion

### Right



Brachial

Common Femoral

High Thigh

Low Thigh

Popliteal

High Calf

Peroneal

Anterior Tibial

Posterior Tibial

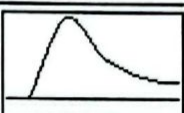
Dorsalis Pedis

Toe Pressure

Post Exercise

### Left

Slightly Reduced



Reduced

68 0.61



Reduced



### Notes

#### RIGHT LOWER LIMB ARTERIAL DUPLEX

#### RIGHT

CFA: Moderate disease, good triphasic waveforms, PSV 202cm/s.

PFA origin: Moderate disease, good triphasic waveforms, PSV 164cm/s.

SFA: Moderate disease at origin, good biphasic waveforms, PSV 174cm/s. Mild/ mod stenosis identified proximally (72cm prox MM) with a velocity increase from PSV 124 to 215cm/s. Stenosis length ~1.3cm.

Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:12 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Graft identified originating off the mid SFA that appears to occlude 1.62cm from origin. Unable to track along length due to small calibre.

Moderate stenosis identified just distal to graft origin (in native vessel) with a velocity increase from PSV 53 to 35cm/s. Stenosis length ~ 1.06cm. Vessel appears to occlude in the distal SFA (46cm prox MM) and remains occluded through the adductor canal where a ?stent was identified.

PopA: Vessel remains occluded until the distal vessel where a large collateral reforms flow (33cm prox MM). Reduced monophasic waveforms, PSV 35cm/s.

TPT is patent. 3 run-off origins noted.

ATA: Flow retrograde at vessel origin. Intermittent flow identified in prox to mid vessel ?obscured disease.

Orthograde reduced monophasic waveforms at ankle, PSV 37cm/s.

PTA: Difficult to visualise in the prox to mid vessel due to depth/ calcified disease. Patent at ankle, reduced monophasic waveforms, PSV 30cm/s.

#### LEFT

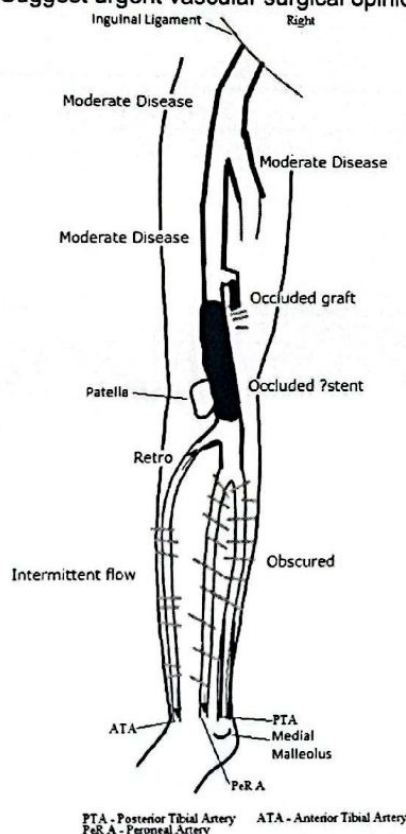
CFA: Slightly reduced monophasic waveforms, PSV 160cm/s ?proximal disease

ATA: Patent at ankle, reduced monophasic waveforms, PSV 24cm/s.

PTA: Patent at ankle, reduced monophasic waveforms, PSV 16cm/s.

Bilateral resting ABPI's are good (Right - 0.64, Left - 0.61)

Suggest urgent vascular surgical opinion



Assessed by Emily Davies, MCVS

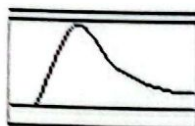
Printed on 08/07/2024 at 3:12 pm

Checked by

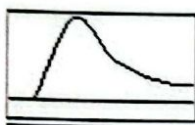
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason Ulceration  
Outcome Obscured, Calcified, Poor Images

## Right



Slightly Reduced



Slightly Reduced

Brachial

Common Femoral

High Thigh

Low Thigh

Popliteal

High Calf

Peroneal

Anterior Tibial

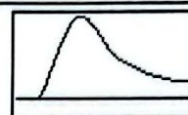
Posterior Tibial

Dorsalis Pedis

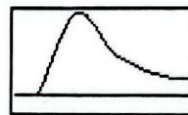
Toe Pressure

Post Exercise

## Left



Slightly Reduced



Slightly Reduced

## Notes

### BILATERAL LOWER LIMB ARTERIAL DUPLEX

\*Low velocities identified throughout scan ?cardiac source ?obscured aorto-iliac disease

\*Challenging examination as patient scanned on ward - limited mobility and dressings - poor images

AORTA: Obscured due to extensive bowel gas and vessel depth

## RIGHT

Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:30 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



CIA: Obscured due to extensive bowel gas

EIA: Prox vessel obscured, however, distal vessel moderate disease and heavily calcified, slightly reduced waveforms, PSV 47cm/s.

CFA: Moderate disease with heavily calcified walls, slightly reduced monophasic waveforms, PSV 33cm/s.

PFA origin: Obscured due to heavily calcified walls

SFA: Moderate diffuse disease along length with heavily calcified walls obscuring large regions of vessel ?obscured disease, slightly reduced monophasic waveforms identified where seen, PSV 36-67cm/s.

PopA: Moderate disease with heavily calcified walls, slightly reduced monophasic waveforms, PSV 33-36cm/s.

ATA: Obscured due to bandages

PTA: Obscured due to bandages

PEROA: Obscured due to bandages

#### LEFT

CIA: Obscured due to extensive bowel gas

EIA: Obscured due to dressings

CFA: Moderate disease with heavily calcified walls, slightly reduced monophasic waveforms, PSV 39cm/s.

PFA origin: Obscured due to heavily calcified walls

SFA: Moderate diffuse disease along length with heavily calcified walls obscuring large regions of vessel ?obscured disease, slightly reduced monophasic waveforms identified where seen, PSV 49-64cm/s.

PopA: Moderate disease with heavily calcified walls, slightly reduced monophasic waveforms, PSV 38cm/s.

ATA: Obscured due to bandages

PTA: Obscured due to bandages

PEROA: Obscured due to bandages

Bilateral resting ABPI's not performed due to dressings, ulceration and pain levels

Suggest alternative imaging

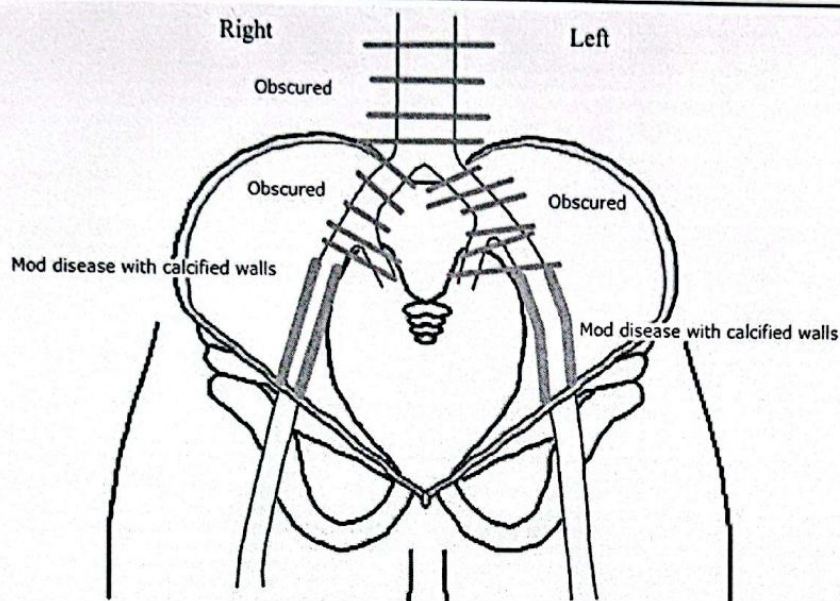
---

Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:30 pm

Checked by \_\_\_\_\_

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

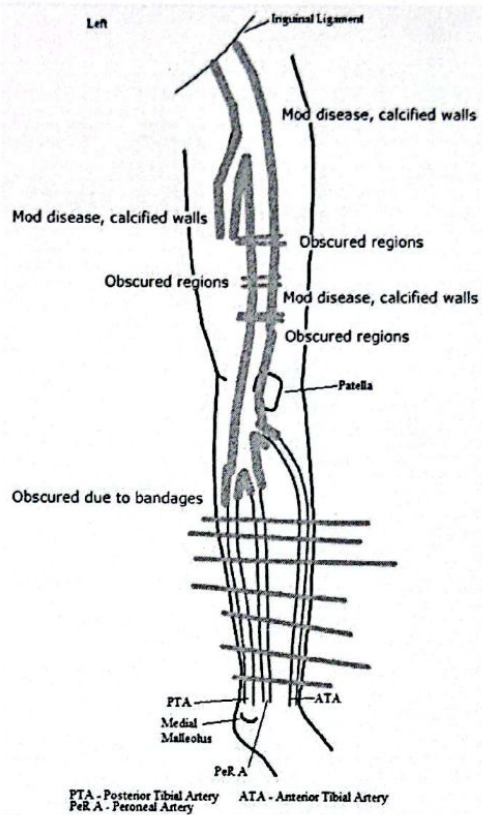
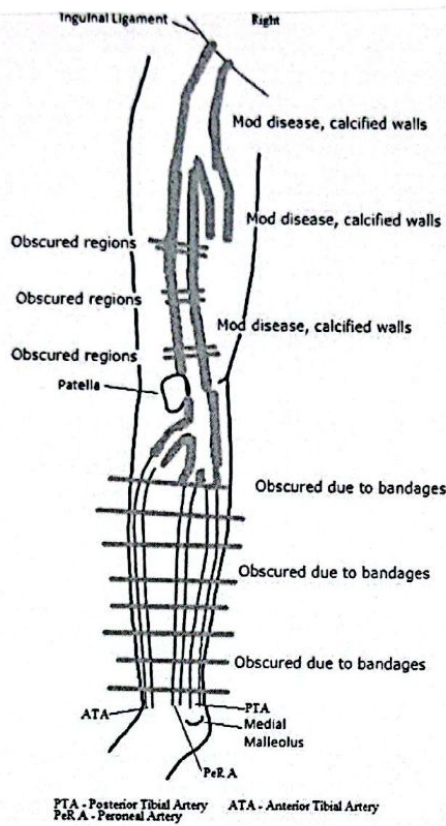


Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:30 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Assessed by Emily Davies, MCVS

Printed on 08/07/2024 at 3:30 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Reason	Routine
Outcome	Calcified, Mild Disease

Right		Left
<div>172 1.00</div> <div>Good</div>	Brachial	
	Common Femoral	Good
	High Thigh	
	Low Thigh	
	Popliteal	Good
	High Calf	
	Peroneal	Good
	Anterior Tibial	Good
	Posterior Tibial	Good
	Dorsalis Pedis	
	Toe Pressure	
	Post Exercise	

**Notes**  
 BILATERAL LOWER LIMB ARTERIAL DUPLEX

**RIGHT**  
 CFA: Mild/ moderate disease, good triphasic waveforms, PSV 230cm/s.  
 PFA origin: Mild/ moderate disease, good triphasic waveforms, PSV 166cm/s.  
 SFA: Mild/ moderate disease with calcified walls, good tri/biphasic waveforms, PSV 124-168cm/s.  
 PopA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 159-204cm/s.

Assessed by	Emily Davies, MCVS
Printed on 11/07/2024 at 11:45 am	Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

TPT is patent. 3 run-off origins noted.

ATA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 106cm/s.

PTA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 162cm/s.

PEROA: Obscured due to oedema

#### LEFT

CFA: Mild/ moderate disease, good triphasic waveforms, PSV 198cm/s.

PFA origin: Mild/ moderate disease, good triphasic waveforms, PSV 91cm/s.

SFA: Mild/ moderate disease with calcified walls, good tri/biphasic waveforms, PSV 138-153cm/s.

PopA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 146-151cm/s.

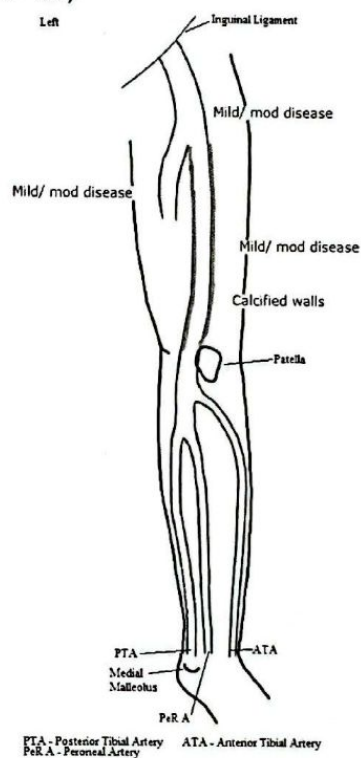
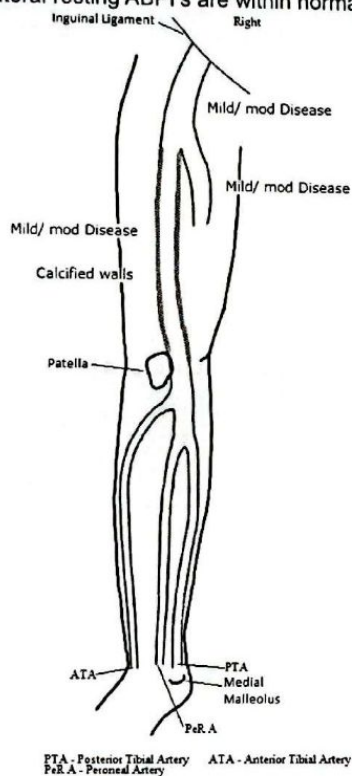
TPT is patent. 3 run-off origins noted.

ATA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 97cm/s.

PTA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 144cm/s.

PEROA: Mild/ moderate disease, good tri/biphasic waveforms, PSV 97cm/s.

Bilateral resting ABPI's are within normal limits (Right - 196, Left - 198)



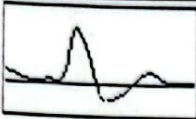
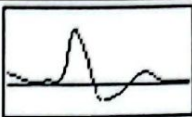
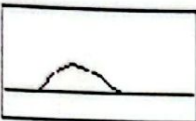
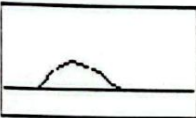
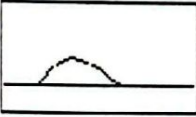
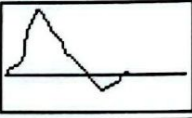
Assessed by Emily Davies, MCVS

Printed on 11/07/2024 at 11:45 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason Compression Bandaging  
Outcome Stenosis mild, Stenosis moderate, Stenosis severe

Right		Left
<div>152 1.00</div> <div></div> <div>Good</div>	Brachial	
	Common Femoral	<div>Good</div> <div></div>
	High Thigh	
	Low Thigh	
<div></div> <div>Reduced</div>	Popliteal	
	High Calf	
	Peroneal	
<div></div> <div>Reduced</div>	Anterior Tibial	
<div></div> <div>Reduced</div> <div>96 0.63</div>	Posterior Tibial	<div>Good</div> <div>156 1.03</div> <div></div>
	Dorsalis Pedis	
	Toe Pressure	
	Post Exercise	

#### Notes

##### RIGHT LOWER LIMB ARTERIAL DUPLEX

##### RIGHT

CFA: Mild disease, good triphasic waveforms, PSV 180cm/s.

PFA origin: Mild disease, good triphasic waveforms, PSV 115cm/s.

SFA: Mild disease proximally, slightly reduced monophasic waveforms, PSV 79cm/s. Mild stenosis identified in the mid vessel (67cm prox MM) with a velocity shift from PSV 99 to 148cm/s. Stenosis length ~0.71cm.

Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 11:40 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Moderate stenosis identified in the mid vessel (65cm prox MM) with a velocity shift from PSV 94 to 185cm/s. Stenosis length ~0.91cm. Severe stenosis identified in the distal vessel (58cm prox MM) with a velocity shift from PSV 119 to 412cm/s. Stenosis length ~ 1.14cm. Another moderate stenosis identified in the distal vessel (56cm prox MM) with a velocity shift from PSV 120 to 280cm/s. Stenosis length ~0.49cm. Distal to stenoses, mild disease, reduced monophasic waveforms, PSV 142cm/s. Vessel patent through AC.  
 PopA: Mild disease, reduced monophasic waveforms, PSV 54-62cm/s.  
 TPT is patent. 3 run-off origins noted.  
 ATA: Mild disease, reduced monophasic waveforms, PSV 47cm/s.  
 PTA: Mild disease, reduced monophasic waveforms, PSV 54cm/s.  
 PEROA: Obscured due to oedema

#### LEFT

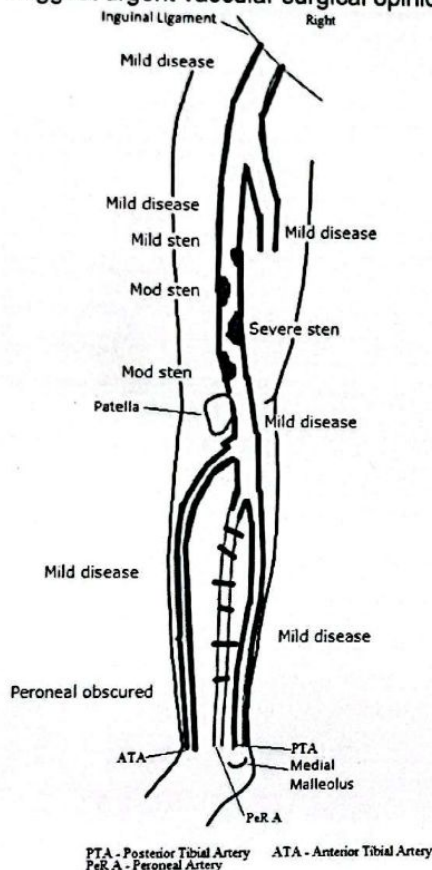
CFA: Patent, good triphasic waveforms

PTA: Patent, good biphasic waveforms at ankle

Right resting ABPI is reduced (Right - 0.63)

Left resting ABPI is within normal limits (Left - 1.03)

Suggest urgent vascular surgical opinion



Assessed by Emily Davies, MCVS

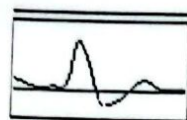
Printed on 29/07/2024 at 11:40 am

Checked by

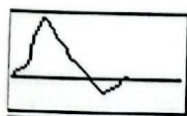
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Reason Ulceration  
Outcome Aneurysm, Occlusion

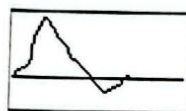
## Right



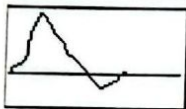
Good



Good



Good



Good

## Brachial

Common Femoral

High Thigh

Low Thigh

Popliteal

High Calf

Peroneal

Anterior Tibial

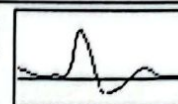
Posterior Tibial

Dorsalis Pedis

Toe Pressure

Post Exercise

## Left



Good

Absent

Weak

## Notes

### BILATERAL LOWER LIMB ARTERIAL DUPLEX

#### RIGHT

CFA: Mild/ moderate calcified disease, good triphasic waveforms, PSV 113cm/s.

PFA origin: Mild/ moderate calcified disease, good triphasic waveforms, PSV 113cm/s.

SFA: Mild/ moderate calcified disease, good biphasic waveforms, PSV 62-113cm/s. Mild stenosis identified in the prox thigh (70cm prox MM) with a velocity shift from PSV 72 to 126cm/s. Disease length ~1.17cm.

Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 3:52 pm

Checked by

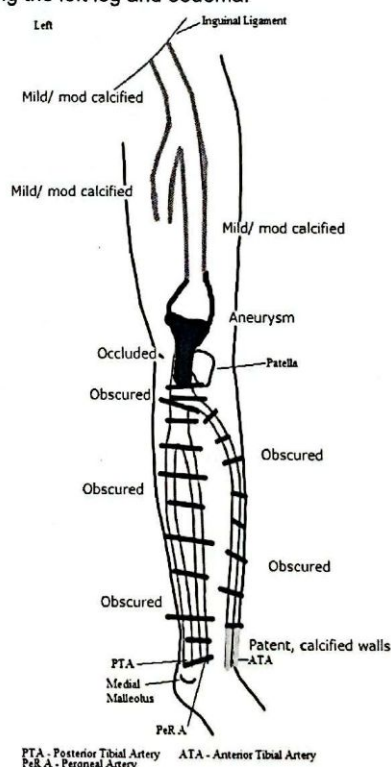
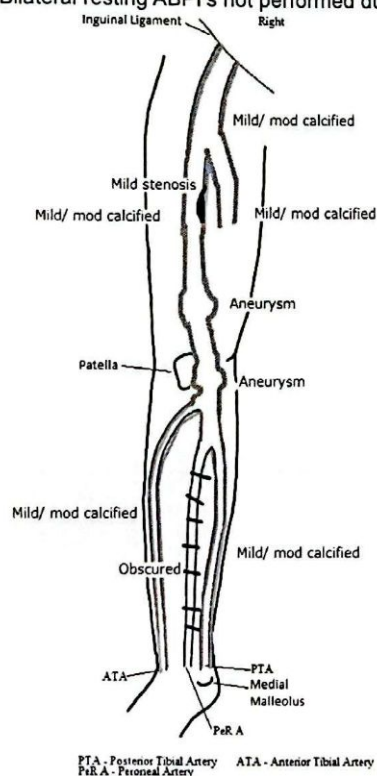
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

Distal SFA appears aneurysmal with maximum dimensions TS = 1.47cm and LS = 1.48cm .  
 PopA: Mild/ moderate calcified disease, good biphasic waveforms, PSV 27-122cm/s. The proximal popliteal artery appears aneurysmal with maximum dimensions TS = 1.68cm, LS = 1.63cm.  
 TPT is patent. 3 run-off origins noted.  
 ATA: Mild/ moderate calcified disease, good biphasic waveforms, PSV 106cm/s.  
 PTA: Mild/ moderate calcified disease, good biphasic waveforms, PSV 43cm/s.  
 PEROA: Obscured due to depth

#### LEFT

CFA: Mild/ moderate calcified disease, good triphasic waveforms, PSV 112cm/s.  
 PFA origin: Mild/ moderate calcified disease, good triphasic waveforms, PSV 64cm/s.  
 SFA: Mild/ moderate calcified disease in the prox to mid vessel, good biphasic waveforms, PSV 74-90cm/s.  
 The distal SFA is aneurysmal with maximum dimensions TS = 3.72cm, LS = 3.64cm. The SFA appears to occlude in the distal aneurysmal SFA. with no flow identified.  
 PopA: No flow identified  
 TPT is obscured  
 ATA: Unable to assess the prox to mid vessel due to dressings. Distal vessel is patent with calcified walls, weak monophasic waveforms, PSV 20cm/s.  
 PTA: Obscured due to dressings  
 PEROA: Obscured due to dressings

Bilateral resting ABPI's not performed due to dressings obscuring the left leg and oedema.



Assessed by Emily Davies, MCVS

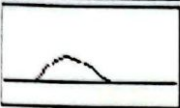
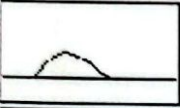
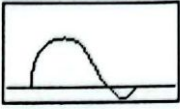
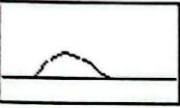
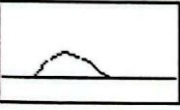
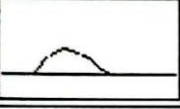

Printed on 29/07/2024 at 3:52 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Reason	Ulceration
Outcome	Obscured, Calcified

Right		Left
	Brachial Reduced	
	Common Femoral Reduced	
	High Thigh	
	Low Thigh	
	Popliteal	
	High Calf Reduced	
	Peroneal Reduced	
	Anterior Tibial Reduced	
	Posterior Tibial	
	Dorsalis Pedis	
	Toe Pressure	
	Post Exercise	

#### Notes

##### RIGHT LOWER LIMB ARTERIAL DUPLEX

AORTA: Prox aorta obscured due to depth and bowel gas. No flow identified in the mid vessel and appears occluded. Distal vessel obscured due to bowel gas and depth.

##### RIGHT

CIA: Obscured due to bowel gas and depth.

Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 3:42 pm

Checked by

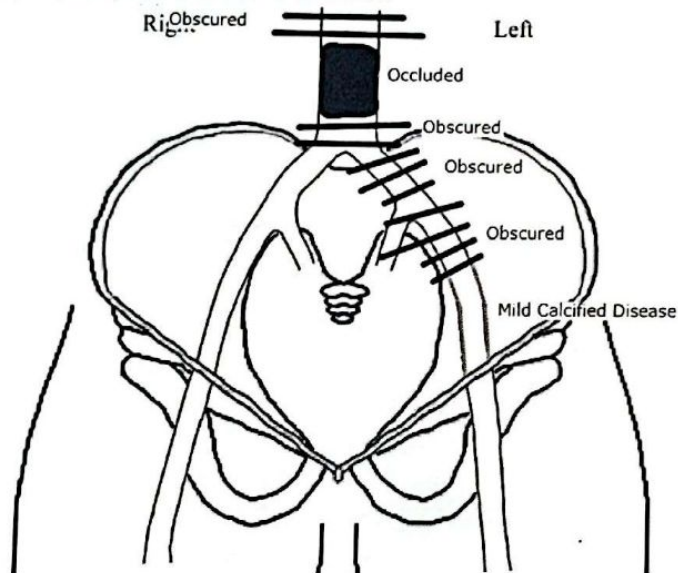
Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

EIA: Prox to mid vessel obscured due to bowel gas and depth. Distal vessel mild disease with calcified walls, reduced biphasic waveforms, PSV 48cm/s.  
 CFA: Mild/ moderate disease proximally, reduced monophasic waveforms, PSV 78cm/s. Moderate stenosis identified at the distal vessel with a velocity increase from PSV 36 to 80cm/s. Stenosis length ~1.32cm.  
 PFA origin: Moderate disease, reduced monophasic waveforms, PSV 71cm/s.  
 SFA: Mild/ moderate disease with calcified walls, reduced monophasic waveforms, PSV 23-34cm/s.  
 PopA: Mild/ moderate disease, reduced monophasic waveforms, PSV 34cm/s.  
 TPT obscured due to calcified disease.  
 ATA: Heavily calcified disease, reduced monophasic waveforms, PSV 41cm/s.  
 PTA: Heavily calcified disease, reduced monophasic waveforms, PSV 29cm/s.  
 PEROA: Heavily calcified disease, weak monophasic waveforms, PSV 13cm/s.

#### LEFT

CFA: Mild/ moderate disease, reduced biphasic waveforms, PSV 39cm/s.  
 ATA: No flow identified ?occluded

Bilateral resting ABPI's not performed due to ulceration

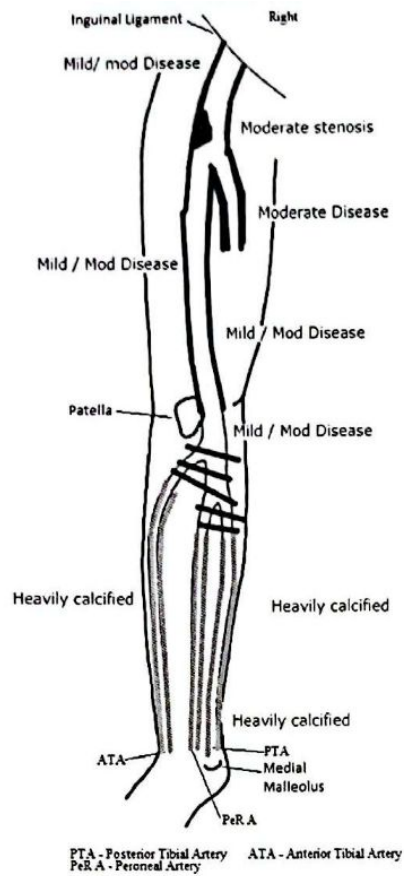


Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 3:42 pm

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



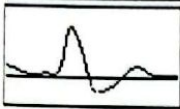
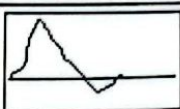
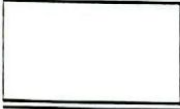


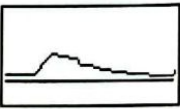
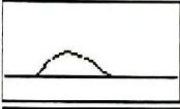
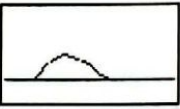
Assessed by Emily Davies, MCVS

Printed on 29/07/2024 at 3:42 pm

Checked by \_\_\_\_\_

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



<b>Reason</b>	Rest pain		
<b>Outcome</b>	Stenosis moderate, Stenosis severe, Obscured, Calcified, Diseased		
<b>Right</b>		<b>Left</b>	
<b>Brachial</b>		<b>Brachial</b>	
	Good	<b>Common Femoral</b>	Good 
<b>High Thigh</b>		<b>High Thigh</b>	
<b>Low Thigh</b>		<b>Low Thigh</b>	
	Absent	<b>Popliteal</b>	Reduced 
<b>High Calf</b>		<b>High Calf</b>	
<b>Peroneal</b>		<b>Peroneal</b>	
	Absent	<b>Anterior Tibial</b>	Weak 
	Reduced	<b>Posterior Tibial</b>	Reduced 
<b>Dorsalis Pedis</b>		<b>Dorsalis Pedis</b>	
<b>Toe Pressure</b>		<b>Toe Pressure</b>	
<b>Post Exercise</b>		<b>Post Exercise</b>	

#### Notes

#### BILATERAL LOWER LIMB ARTERIAL DUPLEX

#### RIGHT

CFA: Moderate disease with heavily calcified walls, good triphasic waveforms, PSV 100cm/s.

PFA origin: Moderate disease with heavily calcified walls, good triphasic waveforms, PSV 165cm/s.

SFA: Difficult to visualise due to heavily calcified disease causing acoustic shadowing and obscuring large regions of the vessel ?significant disease in these obscured regions. Large obscured region identified in the

Assessed by Emily Davies, MCVS

Printed on 30/07/2024 at 10:17 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.

prox vessel for ~1.9cm with a velocity shift from PSV 122 to 40cm/s and a waveform change from good monophasic to slightly reduced monophasic waveforms ?significant stenosis in obscured region. Slightly reduced monophasic waveforms in the distal vessel, PSV 37cm/s before the vessel occludes (56cm prox MM).

PopA: No flow identified through this vessel.

TPT was obscured due to calcified disease

ATA: No flow identified ?occluded along length

PTA: Heavily calcified along length causing intermittent flow, reduced monophasic waveforms at ankle, PSV 21cm/s.

PEROA: Obscured due to calcified disease.

#### LEFT

CFA: Moderate disease with heavily calcified walls, good biphasic waveforms, PSV 117cm/s.

PFA origin: Moderate disease with heavily calcified walls, good triphasic waveforms, PSV 119cm/s.

SFA: Moderate stenosis identified in the proximal vessel (64cm prox MM) with a velocity shift from PSV 64 to 165cm/s. Disease length ~0.98cm. Distal to this large areas of the vessel were obscured. In the mid vessel (59cm) there was a velocity shift from PSV 92 to 426cm/s obtained distal to an obscured region indicative of a severe stenosis. Heavily calcified disease in the distal vessel, reduced monophasic waveforms, PSV 66cm/s.

PopA: Moderate disease with calcified walls, slightly reduced/ reduced monophasic waveforms, PSV 35-53cm/s.

TPT was obscured due to calcified disease

ATA: Heavily calcified along length causing intermittent flow, weak monophasic waveforms at ankle, PSV 19cm/s.

PTA: Heavily calcified along length causing intermittent flow, reduced monophasic waveforms at ankle, PSV 29cm/s.

PEROA: Obscured due to calcified disease.

Bilateral resting ABPI's not performed due to patient being scanned in chair

Suggest urgent vascular opinion

Suggest alternative imaging if appropriate

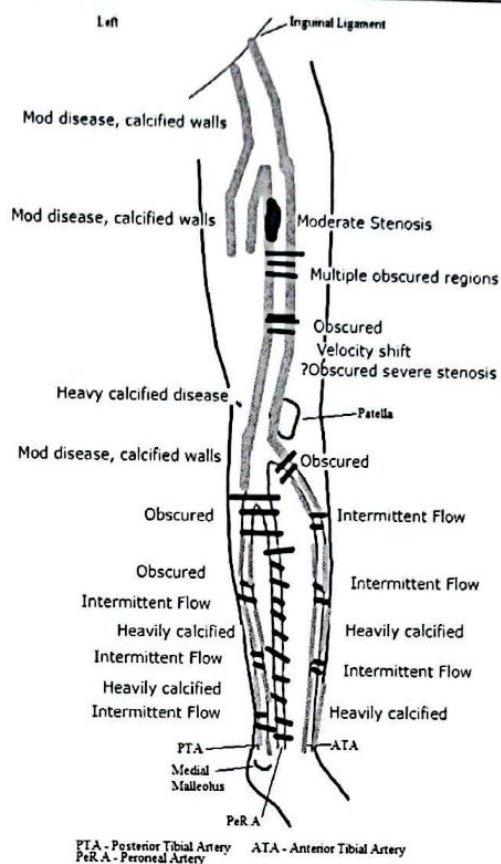
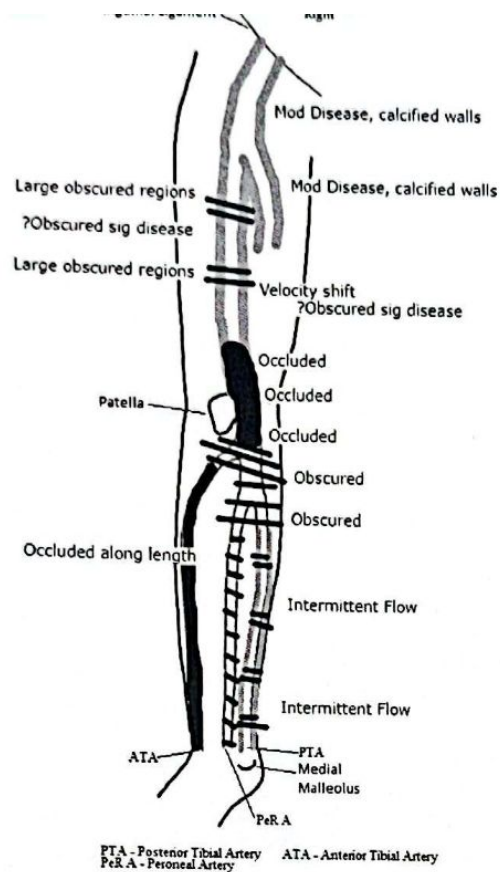
---

Assessed by Emily Davies, MCVS

Printed on 30/07/2024 at 10:17 am

Checked by \_\_\_\_\_

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.



Assessed by Emily Davies, MCVS

Printed on 30/07/2024 at 10:17 am

Checked by

Please note, this is a technical report to be interpreted by a medical professional. If you are a patient reading the report and require further help, please discuss the report with the person who referred you for the examination.