

**Review- 2 yearly**

**Date Version Amendments made**

**May 2022 V2.1 May 2022 – for review May 2024**

**Lower limb arterial duplex**

**Scanning Protocol for Clinical Vascular Scientists**

**V2.1**

**May 2022**

**lower Limb Arterial Duplex**

**Referrals:**

Indication for Referral:

* Claudication
* Rest Pain
* Critical limb Ischemia
* Ulceration/tissue loss/gangrene
* Surveillance following intervention
* Suspected aneurysmal disease, both native and as a result of intervention
* To exclude arterial disease where compression dressings are being considered

Contraindications and Limits: (contraindications are few however there are some limitations e.g.)

* Patients with high body mass index
* The presence of ulcers, wounds, bandaging or casts and for patients who have had

recent surgery, ultrasound visualisation may be limited due to oedema, haematoma,

surgical staples, dressings etc

* Calcified plaque may cause acoustic shadowing limiting Doppler and B-mode image

assessment.

* Patients who are unable to lie still
* Patients who are unable to cooperate due to reduced cognitive functions e.g.

Alzheimer’s or dementia and through involuntary movements

* Examinations undertaken portably at the patient’s bedside maybe limited due to

equipment and room dimensions.

* The presence of catheters or vascular access lines which limit visualisation of the

vessels.

Patients will be referred via the following:

* Hospital consultants
* General practitioners
* Acute GP service
* Vascular one stop clinics

Request may come in the following format:

* ORDERCOMS via CRIS system
* Telephone or email requests MUST be followed by an ORDERCOMS request

Requests must include:

* Patient name, hospital number and/or date of birth
* Referring consultant/GP
* Relevant patient history
* Details of presenting symptoms
* Information required from the investigation

Exam codes to be used:

* ULLAR
* ULLAL
* ULLAB

Inpatient referrals:

* Usually seen with 1 working day of receipt of request (unless a specific date has been requested)
* Request should include:
  + Ward
  + Name of referrer
  + Bleep or contact number
  + Special considerations i.e. infectious status, O2 requirements
  + Mode of transport

Outpatient referrals:

* Routine appointment: 6 weeks
* Urgent: 2- 4 weeks e.g. chronic limb ischaemia
* **Critical e.g. diabetic, sunset foot, acute onset critical limb ischaemic, graft occlusion: within 2 weeks or sooner if required**

One stop clinics:

* Vascular consultants on agreed days/sites and times.
  + Results must be made available immediately

**Examination:**

Equipment: Canon Aplio i700, Canon Aplio i800 or Canon Xario 200

No specific patient preparation is required. Access will be required to the patient’s legs. Scanning may be difficult in patients with open wounds or increased BMI. Sterile dressings or cling film may allow imaging over broken skin.

The Vascular Scientist undertaking the examination should:

* Introduce themselves
* Confirm patient’s identity
* Explain why the examination is being performed, the procedure and the duration
* Obtain verbal consent
* Verify that the requested procedure correlates with the patient’s clinical presentation

Patient Position:

* The patient is asked to remove their clothing to expose the relevant limb to be examined – their dignity and privacy must be maintained at all times (due to the nature of the examination it may be considered necessary to offer a chaperone).
* Position the patient supine or semi-supine on the couch

**Scanning:**

* Select the appropriate frequency probe and appropriate preset depending on body habitus
* Scans should include B-Mode imaging, Colour Doppler imaging and Spectral Doppler
* Scan according to the following standard operating procedure – allowing for limitations previously described
* Begin in the groin using B Mode in the transverse plane to locate and identify the femoral vessels. Assess the vessels for presence of aneurysmal dilatation or plaque.
* Rotate the transducer into a longitudinal plane and using colour Doppler confirm patency of the vessels, while checking for aliasing which may indicate stenosis.
* If significant disease is indicated proximal to the groin examine the aorto-iliac arteries, and examine the opposite groin in view of possible angiogram from the contralateral side
* Using spectral Doppler assess the waveform patterns for phasicity. Establish the Peak Systolic Velocity (PSV) in the normal section of the common femoral artery (CFA), superficial femoral artery (SFA) and profunda femoris artery (PFA)
* Continue interrogation of the SFA along the thigh using B Mode, colour and spectral doppler assessing the vessel for significant plaque, stenosis, occlusion or aneurysm. (If a significant occlusion is present; comment on the quality of the Long Saphenous Vein in the event that a bypass graft is considered)
* Examine the Popliteal Artery (PopA) as above ensuring it is followed throughout its length from adductor to the Tibio Peroneal Trunk (TPT)
* Examine the Posterior Tibial (PTA) Anterior Tibial (ATA) and Peroneal (PerA) Arteries as far distally as possible.

The minimum number of images with spectral Doppler recorded should include:

* CFA
* SFA
* PFA
* PopA
* PTA, ATA and PerA if visualised
* Additional images as deemed necessary for anatomical identification of plaque, stenosis, aneurysms, occlusion or other anatomical anomalies should be recorded.

**PLEASE NOTE: In some situations, e.g. for more complex or technically difficult cases, these protocols may be altered on an individual basis at the discretion of the Clinical Vascular Scientist who is performing the scan**

**Following the examination:**

* Post processing must be competed on CRIS
* The examinations quality code must be entered
* A typed/dictated report must be generated on CRIs for each attendance on the same day as the examination.
* For In Patient referrals – record the following in the patients notes: Date, Time, Examination and Sign, with a statement: The report for the above examination is available on CRIS/Maxims

**Reporting:**

The report is a recording and interpretation of observations made during the lower limb arterial duplex examination. It should be written by the person undertaking the examination and viewed as an integral part of the whole examination. (If the examination is performed by a trainee, then the report should be verified by the person supervising the trainee, until such times as the trainee has been authorised to report independently.) The report should include:

* Correct patient demographics
* Date of examination
* Examination type
* Status of person reporting the examination
* Which arteries have been assessed recording the presence or absence of flow as appropriate
* The anatomical position and length of any occlusions:
  + if a significant occlusion is noted please comment on quality, diameter and length of Long Saphenous Vein in the event that a bypass graft is may be considered.
  + The position, length and severity of any stenoses; X2 velocity increase indicating 50-75%dr stenosis and >x4 velocity increase indicating >75%dr stenosis. Comment and record images of any significant plaque
* The anatomical position and size of any aneurysms:
  + x2 the diameter of a normal segment of artery with 2cm and partly thrombosed or >2.5cm without thrombus generally considered suitable for surgery. Comment on significant thrombus noted within the aneurysm. If aneurysmal disease noted examine the opposite leg Popliteal artery, Common Femoral artery (>3cm surgically significant) and the Aorta (>5.5cm surgically significant), Iliac arteries (>4cm surgically significant). If Aorta >7.5cm Inner to Inner measurement keep the patient in the department and contact a Vascular Radiologist to arrange a CT.
* Examine all three calf arteries documenting significant disease/stenosis.
* Limitations of the assessment e.g. body habitus, calcified vessels, bowel gas
* Conclusion of findings
* If the investigation is a surveillance or follow up scan the report should give details of the intervention and should specifically comment on the patency of flow in the region of the intervention.
* Conclusion of findings including any limitations of the examination and recommendation for additional/alternative imaging if deemed necessary by the vascular scientist

**Pathway for Lower Limb Arterial Duplex imaging/reporting:**

* GP / Consultant Outpatient: patient goes home, report generated on CRIS
* Vascular Clinic: patient returns to the clinic, report generated on CRIS
* For In Patient referrals – record the following in the patients notes:

Date, Time, Examination and Sign, with a statement: The report for the above examination is available on CRIS/Maxims

**For patient with sudden onset or deterioration of symptoms i.e. rest pain or with other significant findings i.e. large aneurysm bleep the on call Vascular Reg for the day via switchboard for advice.**

**Additional Information:**

**Reporting Criteria:**

Any areas where the colour flow Doppler appears disturbed should always be interrogated

with pulsed Doppler. The highest peak systolic velocity should be measured at the site of the

disturbance or narrowing (Vs) and in a normal area of the artery just proximal to the narrowing

(Vp). Care should be taken to ensure that the Doppler angle is 60º or less when recording

velocity measurements.

The main criterion used to grade the degree of narrowing in the artery is the ratio of Vs to

Vp, known as the peak systolic velocity (PSV) ratio:

|  |  |
| --- | --- |
| **PSV =** | **Vs** |
| **Vp** |

The PSV ratio is used to grade the severity of the narrowing.

* A PSV ratio of greater than 2 is generally used to define a stenosis that is causing a greater than 50% reduction in the diameter of the artery.
* A PSV ratio of greater than 4 is generally used to define a stenosis that is causing a greater than 75% reduction in the diameter of the artery.

Changes in the shape of Doppler waveforms are important criteria in determining the presence of disease. Multiphasic waveforms are representative of normal flow, whereas monophasic/damped waveforms usually represent diseased flow.

**Diagnostic Criteria for Stenosis:**

Peak Systolic Velocity(PSV) Ratio is the main criterion to grade the degree of narrowing in the artery.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Normal PSV of lower limb:** | |  | **PSV Ratio and % degree of stenosis** | |
| **ARTERY** | **PSV cm/s (+/- SD)** |  | **PSV Ratio** | **% stenosis** |
| Aorta | **0.80(+/- 0.25)** |  | **<2.0** | **<50** |
| Iliac | **1.10 (+/-0.25)** |  | **2.0 – 2.5** | **50 – 60** |
| CFA | **1.15 (+/-0.25)** |  | **>2.5** | **>60** |
| SFA | **0.90 (+/- 0.15)** |  | **>4.0** | **>75** |
| PopA | **0.69 (+/- 0.15)** |  | **Numerous lesions without any alteration in PSV or PSV<2.0** | **Diffuse disease** |
| PTA/ATA/PerA | **0.61 (+/- 0.20)** |  |
|  |  |  | **Absence of flow** | **Occluded** |

**Absolute values of PSV give a good indication of disease but, it is affected by cardiac output and proximal disease**

**By-Pass Grafts (See Post Bypass Graft Duplex Assessment Protocol):**

* The entire length of the graft should be scanned paying particular attention to the anastomoses. The inflow and outflow should also be assessed.
* As a guide the following criteria may be used along with other indicators:
  + Velocities of <45cm/s may indicate an ‘at risk’ graft.
  + Volume flow >100mls/min is considered normal

**Stents:**

* Particular attention should be given to imaging and assessing flow through the stent together with an assessment of the inflow and outflow to the stented area.
* In cases of diameter mismatch (e.g. large diameter graft joined onto a smaller diameter outflow vessel), consideration can be given to using a distal peak systolic velocity instead of Vp

**Popliteal Artery Aneurysm:**

A PopA aneurysm is considered suitable for surgery if it is x2 diameter of a normal segment of artery, within 2cm and thrombosed or >2.5cm without thrombosis. If aneurysmal disease is detected go on to examine:

* Common femoral arteries (>3cm surgically significant)
* Aorta (>5.5cm surgically significant)
* Iliac Arteries (>4cm surgically significant)
* Contralateral PopA

*NB if the aorta is >7.5cm inner to inner measurement, keep the patient within the department and contact a Vascular Radiologist to arrange a CT. See Appendix I (Ultrasound Protocol for Abdominal Aortic Aneurysms, Incidental Findings)*

|  |  |
| --- | --- |
| **NORMAL DIAMETER OF LOWER LIMB ARTERY** | |
| **ARTERY** | **AP DIAMETER (MM)** |
| CIA | 10 – 12 |
| EI | 8 – 10 |
| CFA | 7 – 9 |
| SFA | 6 – 8 |
| PopA | 4 - 6 |

**Equipment and Environment Cleaning:**

* Under ALL circumstances equipment should be cleaned according to the Trust Decontamination Policy: <http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10167107>
  + Appendix 3: Summary of methods for decontamination of equipment and environment
  + Appendix 4: A-Z Guide to methods of decontamination of equipment
  + Appendix 5: Procedure for manual cleaning
  + Appendix 6: Decontamination of equipment prior to service or repair

**During a Viral Epidemic/Pandemic please refer to the VSU Covid-19 Cleaning Protocol**

**PPE:**

**Please refer to Document Library for current guidance on the use of PPE – NB these are subject to change based on government advice.**

Mask Guidance: [**http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360648**](http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360648)

PPE and Uniform Guidance: [**http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360695**](http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10360695)

**Sterile gel should be used in the following settings:**

* If an invasive procedure is likely to be undertaken in the following 24 hours**, including dialysis via a fistula.**
* Where there is contact with or near to non-intact skin (any alteration in skin integrity such as a rash or surgical wound).
* Where the ultrasound examination is near to an indwelling invasive device, such as an intravenous line or suprapubic catheter.
* For examinations on severely immunocompromised individuals (eg. Chemotherapy patients)
* In an intensive-care setting, high-dependency, or equivalent units.

**References:**

Institute of Physics and Engineering in Medicine/ The Society of Vascular Technology for Britain and Ireland: Vascular Laboratory Practice, Part III, *Cole S.E.A., Walker R.A, Norris R.*

The Society for Vascular Technology of Great Britain and Ireland; Vascular Technology Professional Performance Guidelines, Arterial Duplex Ultrasound Examination.

<https://www.svtgbi.org.uk/media/resources/Arterial_PPG_-_new_format.pdf>

Vascular Studies Unit Diagnostic Testing Procedures: *Gazzard V*. <http://doclibrary-rcht-intranet.cornwall.nhs.uk/GET/d10254458>

***Appendix I***

**Ultrasound Protocol for Abdominal Aortic Aneurysms**

Supra renal > 3.5cm or Supra renal aneurysm

3-5cm

Iliacs >3cm

2.5-3cm

Further imaging to exclude thoracic aortic aneurysm

Report as slightly enlarged. If <70yrs F/U depends on risk factors. If >70yrs ? F/U

Vascular Surgeon

Referral

Urgent Vascular surgeon

Referral recommended.

Phone surgery

5-7.5cm

>5cm and symptomatic

Or >7.5cm

Urgent

Report. Immediately notify

Surgeon

>7.5cm or

symptomatic and greater than 5cm

Keep patient, & contact the Vascular Radiologist

>5cms

<5cms

GP/Incidental findings

>5 <7.5cm or symptomatic and less than 5cm

Refer to Vascular Surgeon/Routine surveillance

Report size as no significant

change

Report

change in

size and

time period

Urgent

Report. Immediately

notify surgeon

Report size

And change as

significant

Keep patient,

& contact the vascular surgeon.

Increase

>1cm

Increase

>0.5 <1cm

Increase

<0.5cm

**25 EXAMPLES OF MY ARTERIAL SCANS**

1. US Doppler lower limb arteries Lt :

Good triphasic flow in the common femoral artery which has only minor atheroma. Patent profunda. There is minor-moderate disease in the proximal-mid superficial femoral artery (SFA), then a short ~4cm atheromatous occlusion mid-distally. Monophasic flow into the popliteal artery. Calcified disease of the anterior tibial and posterior tibial arteries but both vessels likely patent throughout. Only patchy flow seen in a small diseased peroneal artery.

CONCLUSION: SHORT OCCLUSION OF THE DISTAL SUPERFICIAL FEMORAL ARTERY.

You may wish to refer to vascular surgery if clinically appropriate.

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1. US Doppler lower limb arteries Lt :

There is excellent triphasic flow in the CFA, no concerns over iliac disease. The distal CFA and PFA/SFA origins are obscured by calcification, probable profunda origin stenosis but likely only moderate at SFA origin. There is further moderate disease upper thigh then critically tight >90% stenosis of the SFA ~10cm distal to its' origin. The SFA then becomes completely obscured by calcification distally, possible short occlusion. There is a full length popliteal artery occlusion and tibioperoneal trunk. The anterior tibial and posterior tibial arteries reconstitute and are patent to the foot. The peroneal artery is occluded.

The LSV has been previously harvested for bypass from mid-thigh to calf.

CONCLUSION: CRITICALLY TIGHT PROXIMAL SFA STENOSIS WITH FURTHER DISEASE DISTALLY. FULL LENGTH POPLITEAL ARTERY OCCLUSION.

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1. US Doppler lower limb arteries Rt :

There is 50-75% stenosis of the mid-distal CFA (calcified). Flow suggests possible moderate/borderline significant iliac disease but not scanned directly. Turbulent flow in the profunda suggesting significant stenosis at its origin (obscured).

There is diffuse disease in the SFA with ~50% stenosis proximally and mid-thigh, then a short 15mm occlusion distally. Very damped flow into the popliteal which is normal calibre. Poor flow in all three run-off vessels, posterior tibial artery likely not in continuity (calcified).

US Doppler lower limb arteries Lt :

Brief scan but there is diffuse moderate <50% disease throughout the CFA and SFA. Triphasic flow in the CFA. Significant >50% stenosis of the proximal popliteal, then critically tight stenosis mid-distally with possible occlusion (very calcified). The popliteal artery is of normal calibre. Damped flow in the run-off vessels.

CONCLUSION: RIGHT CFA STENOSIS AND SHORT SFA OCCLUSION. TIGHT LEFT POPLITEAL STENOSIS/OCCLUSION.

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1. US Doppler lower limb arteries Both :

RIGHT

There is bulky atheroma in the CFA, visually >50% but haemodynamically <50%. This also involves the SFA origin which again is visually >50% but not haemodynamically. Waveforms in the proximal CFA suggest possible stenotic iliac disease.

The SFA is diseased throughout with several moderate <50% stenoses proximal-mid thigh, then a long significantly stenosed segment mid-distally (max. 75% stenosed). There is a further segment distally obscured by calcification, ?short occlusion as flow more damped into popliteal. There is moderate atheroma in the proximal popliteal artery. Damped monophasic flow in all three run-off vessels

LEFT

There is a critically tight CFA stenosis, which is diseased throughout, likely some stenotic iliac disease. The PFA origin is also stenosed. There is moderate <50% disease throughout the SFA, then a short <10cm above knee popliteal artery occlusion. Damped monophasic flow in the anterior and posterior tibial arteries.

CONCLUSION: BILATERAL SIGNIFICANT FEMORO-POPLITEAL DISEASE. LIKELY SOME ILIAC STENOSES ALSO.

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1. US Doppler lower limb arteries Lt :

There is turbulent damped flow in the left CFA. Iliacs therefore scanned which shows >75% proximal left external iliac artery stenosis. No evidence of significant aorta or left CIA disease.

The CFA has only minor disease. Patent profunda. High resistance flow in the proximal SFA, with ~10cm occlusion mid-thigh. Refilling distally with no significant disease here or in the popliteal, flow is damped monophasic. The posterior tibial and peroneal arteries are likely patent throughout, the anterior tibial artery occludes mid-calf with refilling at the ankle.

CONCLUSION: >75% LEFT EXTERNAL ILIAC ARTERY STENOSIS AND 10CM SFA OCCLUSION.

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1. US Doppler lower limb arteries Rt :

Poor views of the iliac arteries due to body habitus but velocities suggest >50% proximal-mid external iliac artery stenosis. Unable to comment on common iliac disease. There is then bulky atheroma in the mid-distal CFA causing approx. 50-60% haemodynamic stenosis. This also includes the profunda origin. There is then 60-70% stenosis of the mid-distal SFA. No significant disease in the popliteal artery. The anterior tibial and posterior tibial arteries are patent with monophasic flow.

Exercise ABPI with heel raises also performed for training purposes, and I thought you may find this information useful. However the patient does have SFA disease so results will reflect this as well as the CFA/iliac disease.

On the right the ABPI dropped from 0.87 to 0.45 post heel raises. The patient experienced right buttock claudication after 30seconds, after 45secs he also had right calf claudication. After 55 seconds the right calf pain progressed and the test was stopped after one minute 15 seconds due to pain. He experienced some claudication on the left but less significant.

CONCLUSION: Right external iliac, CFA and SFA stenoses remaining. The SFA disease being the tightest.

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1. US Doppler lower limb arteries Rt :

There is good bi/triphasic flow in the CFA, which has minor disease distally. No suggestion of significant proximal disease. Patent profunda. The SFA has a >75% stenosis upper thigh, then a long 50-60% stenosed segment mid-distally. Further ~50% stenosis in the above knee popliteal artery, with no disease mid-distally. The anterior tibial and posterior tibial arteries are patent with strongly monophasic flow. Poor biphasic flow in the peroneal artery which may have occlusions.

CONCLUSION: MULTIPLE SIGNIFICANT SFA STENOSES.

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1. US Doppler lower limb arteries Rt :

Scanned with Xario machine (reduced image quality)

Triphasic flow throughout the femoro-popliteal segment with only minor disease <25%

The posterior tibial artery is patent but with critically tight stenosed segment proximal-mid vessel, and 50-75% stenosis mid-distally with monophasic flow distally. The anterior tibial artery has several occlusions with poor flow distally. The peroneal artery is small and poorly seen but has low velocity flow distally.

CONCLUSION: SIGNIFICANT DISEASE OF RUN-OFF VESSELS.

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1. US Doppler lower limb arteries Both :

RIGHT

There is good upstroke in the CFA (no significant iliac disease suspected). The CFA has moderate disease <50%. The SFA is diseased and calcified throughout, obscuring some segments. There is >50% stenosis mid-thigh and likely further significant disease in the obscured segments. ?Short occlusion distally. Flow is damped into the popliteal artery which has moderate <50% disease. As seen previously, the peroneal artery is the only patent run-off vessel, which supplies the dorsalis pedis (poor flow).

LEFT

The CFA is patent with good flow which suggests no significant proximal disease, it has minor atheroma <25%. There are multiple significant stenoses of the SFA, the tightest being >75% distally. No significant disease in the popliteal which has damped, but better flow than on the right. The peroneal is again the only patent run-off vessel, supplying the dorsalis pedis.

CONCLUSION: Similar to previous scan; significant bilateral SFA disease with single vessel run-off.

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RCHT

1. US Doppler lower limb arteries Lt :

There is good triphasic flow in the CFA with mild-moderate disease proximally (<50%). Patent profunda. There is minor disease in the SFA <25%. The popliteal artery is occluded mid-distally with no reconstitution. The anterior tibial artery is occluded. The posterior tibial artery is patent at least distally with poor monophasic flow.

US Doppler iliac & femoral artery Both :

The left external iliac artery is patent with good triphasic flow and no significant stenosis.

CONCLUSION: POPLITEAL ARTERY OCCLUSION. GOOD FLOW AT THE GROIN.

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1. US Doppler lower limb arteries Lt :

Triphasic flow in the CFA suggests no significant proximal disease. Moderate disease in the CFA becoming heavily calcified distally. Patent profunda. There is >75% stenosis at the origin of the SFA, with diffuse disease throughout the SFA and approx. 50% stenosis mid thigh. The popliteal has extensively calcified atheroma throughout, likely occluded. Unable to see upper calf arteries in great detail but anterior tibial likely patent throughout, and the posterior tibial and peroneal arteries are patent at least distally. Flow is poor.

CONCLUSION: TIGHT PROX. SFA STENOSIS AND POPLITEAL ARTERY OCCLUSION.

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1. US Doppler lower limb arteries Lt :

There is damped monophasic flow in the CFA suggesting proximal occlusion. Likely >50% disease in the CFA also. Patent profunda. The SFA is diffusely diseased throughout becoming obscured by calcification mid-thigh where there is likely significant stenosis, but recommend correlation with angio. Moderate disease in the popliteal artery which has poor flow.

Difficult views of the calf vessels as patient struggling to tolerate scan by this point. The posterior tibial artery is patent mid-distally but unable to see proximally. The anterior tibial artery is occluded. Some flow detected in distal peroneal artery but unable to determine if in continuity.

The thigh LSV is only 2mm diameter making it unsuitable for bypass if this is being considered.

There is turbulent and damped flow in the right groin suggesting significant stenosis proximally but unlikely an occlusion. Patient unable to tolerate any further scanning so full aorto-iliac scan not performed.

CONCLUSION: SEVERE MULTILEVEL DISEASE. LIKELY ILIAC OCCLUSION.

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1. US Doppler lower limb arteries Rt :

Triphasic flow in the common femoral artery. Patent profunda. There is diffuse disease in the superficial femoral artery with just under 50% stenosis lower thigh. There is then 50-75% stenosis mid-popliteal artery.

Run-off is via the anterior tibial artery, with multiple occlusions of the posterior tibial and peroneal arteries. The dorsalis pedis is initially patent, but unsure of its patency distally, possibly occluded.

CONCLUSION: Stenotic femoro-popliteal disease and single vessel run-off. Suggest advice from the vascular team.

1. US Doppler lower limb arteries Rt :

Good triphasic flow from groin to ankle with no evidence of significant arterial disease. The popliteal artery is of normal calibre with no aneurysm.

Good triphasic flow on the left also.

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1. US Doppler lower limb arteries Both :

RIGHT

Triphasic flow in the CFA which has just less than 50% disease. Diffuse moderate disease throughout the femoro-popliteal segment, borderline 50% mid-distal SFA. Good triphasic flow into the popliteal artery and all three run-off vessels.

LEFT

There is 50-75% stenosis along the full length of the CFA. Profunda origin obscured but poor flow beyond this suggests possible origin occlusion/severe stenosis. The SFA origin and proximal SFA is heavily calcified, >50% stenosis upper-mid thigh. Monophasic flow into the popliteal artery. Good posterior tibial and peroneal arteries, occluded distal anterior tibial.

US Doppler aortoiliac :

The AAA remains 54mm diameter inner-inner wall.

The right common iliac artery (CIA) has some calcification at its origin, not haemodynamically significant but is protruding well into the lumen. The right CIA then becomes aneurysmal mid-distally measuring 25mm diameter. Good triphasic flow in the right external iliac artery.

There is >75% stenosis of the left prox-mid external iliac artery. Some turbulent flow above here suggests possible left CIA stenosis but poorly seen due to bowel gas.

CONCLUSION: 1) STABLE 54MM AAA AND 25MM RIGHT CIA.

2) LEFT MULTILEVEL SIGNIFICANT ARTERIAL DISEASE.

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1. US Doppler lower limb arteries Rt :

Good triphasic flow throughout the femoro-popliteal segment with no significant stenosis.

The below knee arteries are very heavily calcified. There is good triphasic flow in the anterior tibial and posterior tibial arteries down to the level of the ulcer, below this level the arteries become largely obscured by calcification but velocities suggest >50% stenosis in the very distal anterior and posterior tibial arteries (but below the level of the wound), with flow becoming more turbulent. Unable to visualise the peroneal.

1. US Doppler lower limb arteries Rt :

There is triphasic but low velocity flow throughout the CFA, PFA and SFA. No significant aorto-iliac disease suspected. There is an abrupt occlusion of the popliteal artery at knee crease level with no reconstitution. Looks like possible thrombus or very soft plaque, ?fairly acute. Largely occluded run-off vessels with small segments of flow, the only target for bypass would be the very distal anterior tibial artery/dorsalis pedis.

US Doppler vein map lower limb Both :

Excellent right LSV measuring 3.5-4mm diameter throughout.

CONCLUSION: POPLITEAL AND THREE VESSEL RUN-OFF OCCLUSION.

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1. US Doppler lower limb arteries Lt :

There is turbulent, damped monophasic flow in the CFA suggesting proximal obstruction, and a short ~15mm occlusion distal CFA (recommend correlation with CT as poorly seen). There is >75% stenosis of the mid external iliac artery and possible further disease distal common iliac/prox. external iliac (obscured by bowel). The proximal-mid common iliac artery is only mildly diseased. Apologies right iliacs not scanned as patient in great discomfort.

Patent profunda. Poor flow in proximal-mid SFA (no significant disease here), then occlusion of mid-distal SFA approx. 15cm length. There is refilling of the popliteal artery at knee crease level with no significant disease in this vessel, flow is very poor. The run-off vessels are underfilled, the anterior tibial and posterior tibial arteries are patent.

US Doppler vein map lower limb Lt :

The LSV measures 4mm upper thigh, ~2.8mm lower thigh and calf (borderline suitable). Mid-lower calf there is scarring.

CONCLUSION: ILIAC AND FEMORAL ARTERY DISEASE CAUSING VERY POOR FLOW.

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1. US Doppler lower limb arteries Rt :

There is triphasic flow in the common femoral artery at the profunda. There is diffuse disease throughout the SFA with several <50% stenoses, and borderline 50% stenosis mid-thigh where there is a possible small dissection flap, but may just be residual plaque. Flow is strongly monophasic into the popliteal artery, and in all three run-off vessels down to the level of the bandaging.

CONCLUSION: SFA REMAINING PATENT WITH MODERATE/JUST 50% DISEASE.

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1. US Doppler lower limb arteries Lt :

There is moderate disease in the common femoral artery (<50%). There is damped monophasic flow in the common femoral artery suggesting proximal obstruction. Poor views of the aorto-iliac segment (Xario, reduced image quality machine), but very likely bilateral common iliac disease. Patent profunda.

There is high resistance flow in the proximal superficial femoral artery suggesting distal occlusion, and an approx. 10cm length occlusion starting mid-thigh with refilling above the knee. The popliteal artery is patent with no significant disease and very damped flow. The posterior tibial and peroneal arteries are patent, anterior tibial likely occluded.

CONCLUSION: SIGNIFICANT ILIAC AND FEMORAL DISEASE.

Recommend referral to vascular surgeons, the patient describes lifestyle limiting symptoms.

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1. US Doppler lower limb arteries Lt :

There is good triphasic flow throughout the femoro-popliteal segment and good bi/triphasic flow in all three run-off vessels with no significant stenoses.

CONCLUSION: NO EVIDENCE OF SIGNIFICANT ARTERIAL DISEASE.

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1. (Also scanned veins) US Doppler lower limb arteries Lt :

There is triphasic flow throughout the femoro-popliteal segment with only minor disease. Velocities are lower than expected, ?cardiac cause.

The anterior tibial and peroneal arteries are patent but with a tight >75% stenosis at the origin of the anterior tibial artery, and ~75% stenosis in the proximal peroneal. Flow becomes of very low velocity in the anterior tibial but I think this is likely partially due to cardiac output. The posterior tibial artery has several occlusions.

CONCLUSION: RUN-OFF DISEASE AND SUSPECTED POOR CARDIAC OUTPUT.

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1. US Doppler lower limb arteries Lt :

Slightly turbulent triphasic flow in the CFA, ?moderate iliac disease. >50% stenosis of the profunda origin. Just beyond the origin of the SFA there is a short segment completely obscured by calcification with flow patterns suggesting significant stenosis/occlusion here. There is then a critically tight >90% stenosis mid-SFA, and further moderate disease distally. The popliteal artery is patent with damped monophasic flow and no aneurysm or significant disease.

Unable to scan calf due to dressings/ulcers.

CONCLUSION: SIGNIFICANT SFA DISEASE.

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1. US Doppler lower limb arteries Lt :

There is good triphasic flow in the CFA, no significant iliac disease suspected. Patent profunda. The SFA is diseased throughout with several just over 50% stenoses, and a short <10cm occlusion mid-thigh, with further stenoses distally.

The popliteal artery is patent with biphasic but reduced velocity flow. The anterior tibial artery is patent with biphasic flow. The posterior tibial artery is calcified with likely occlusion distally, flow becomes damped monophasic. Biphasic flow detected in the peroneal artery.

CONCLUSION: SIGNIFICANT SFA DISEASE WITH SHORT OCCLUSION.

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1. US Doppler lower limb arteries Rt :

There is good triphasic flow in the CFA which has minor disease. Patent profunda. The proximal SFA is underfilled with pre-occlusive flow. There is an approx. 12cm occlusion mid-thigh. The distal SFA and popliteal are underfilled with poor flow, and moderate disease, the distal popliteal artery looks reasonable. There appears to be three vessel run-off, flow is very damped.

The LSV has been previously harvested.

CONCLUSION: MID-SFA OCCLUSION