# Carotid

## YGC Vascular Laboratory

1.

RT and LT SIDES. ( ICA stenosis grading criteria are based on NASCET criteria.)

Normal appearances and Doppler signals in both CCA, carotid bulbs, proximal ICA & ECA.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY: No evidence of extra-cranial cerebro-vascular disease on either side.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

2.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

RIGHT

Intimal thickening/ calcification in the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

LEFT

Normal appearances of the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY:

Rt side: Minimal disease proximal ICA.

Lt side: Normal appearances proximal ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

3.

RT & LT SIDES: ( ICA stenosis gradings are based on NASCET Criteria)

Calcified plaque in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both CCA, ICA and ECA.

Normal Doppler signals in both subclavian arteries.

Both vertebral arteries are patent with antegrade flow.

Known abdominal aortic aneurysm has increased in size.

Maximum inner AP diameter now measures 4.1 cm.

SUMMARY:

Rt side: < 50 % stenosis proximal ICA.

Lt side: Mild disease proximal ICA.

Known 4.1 cm abdominal aortic aneurysm.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

4.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

RIGHT

Intimal thickening/ calcification in the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

LEFT

Normal appearances of the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

Aortic Aneurysm Screening: The abdominal aorta is of normal calibre.

SUMMARY:

Rt side: Minimal disease proximal ICA.

Lt side: Normal appearances proximal ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

5.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening/ calcification in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

Aortic Aneurysm Screening: The abdominal aorta is of normal calibre.

SUMMARY: Minimal disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

6.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

RIGHT

Soft plaque in the proximal ICA forming a > 90% stenosis.

Raised velocities in the proximal ICA. Reduced velocities in the CCA. Normal Doppler signals in the ECA.

LEFT

Intimal thickening in the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY:

Rt side: > 90% stenosis proximal ICA.

Lt side: Minimal disease proximal ICA.

Right ICA stenosis grading confirmed by Grant Robinson, Chief Clinical Vascular Scientist.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

7.

RT and LT SIDES. ( ICA stenosis grading criteria are based on NASCET criteria.)

Normal appearances and Doppler signals in both CCA, carotid bulbs, proximal ICA & ECA.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

Aortic Aneurysm Screening: The abdominal aorta is of normal calibre.

SUMMARY: No evidence of extra-cranial cerebro-vascular disease on either side.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

8.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

RIGHT

Normal appearances of the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

LEFT

Intimal thickening/ calcification in the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY:

Rt side: Normal appearances proximal ICA.

Lt side: Minimal disease proximal ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

9.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening/ calcification in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY: Minimal disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

10.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening/ calcification in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

Aortic Aneurysm Screening: The abdominal aorta is of normal calibre.

SUMMARY: Minimal disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

11.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

RIGHT

Normal appearances of the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

LEFT

Intimal thickening/ calcification in the carotid bulb / proximal ICA.

Normal Doppler signals in the common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY:

Rt side: Normal appearances proximal ICA.

Lt side: Minimal disease proximal ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

12.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening/ calcification in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

SUMMARY: Mild disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

13.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

Aortic Aneurysm Screening: The abdominal aorta is of normal calibre.

SUMMARY: Minimal disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

14.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening/ calcification in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

3.9 x 3.9 x 3.2 cm complex cystic structure in the left supra-clavicular region.

This examination was performed immediately after a CT with contrast study for multinodular goitre.

SUMMARY: Mild disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

15.

RT and LT SIDES.( ICA stenosis grading criteria are based on NASCET criteria.)

Intimal thickening/ calcification in both carotid bulbs/ proximal ICA.

Normal Doppler signals in both common, internal and external carotid arteries.

Both vertebral arteries are patent with antegrade flow.

Normal Doppler signals in both subclavian arteries.

Aortic Aneurysm Screening: The abdominal aorta is of normal calibre.

SUMMARY: Minimal disease both ICA.

Performed and reported by Guy Chapman, Trainee Clinical Vascular Scientist.

## YMH Vascular Laboratory

16.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow. Intimal thickening proximally (< 25% stenosis).

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow. Intimal thickening at the bifurcation (< 25% stenosis).

ECA- Normal flow.

ICA- Normal flow. Soft plaque proximally (< 25% stenosis).

VA- Normal antegrade flow.

17.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow.

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow.

VA- Normal antegrade flow.

18.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow. Intimal thickening distally (< 25% stenosis).

ECA- Normal flow.

ICA- Normal flow. Soft plaque proximally (< 25% stenosis).

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow. Intimal thickening and calcification distally (< 25% stenosis).

ECA- Normal flow.

ICA- Normal flow. Mixed plaque proximally (25-49% stenosis).

VA- Normal antegrade flow.

19.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow. Intimal thickening at the bifurcation (< 25% stenosis).

ECA- Normal flow.

ICA- Normal flow.

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow.

VA- Normal antegrade flow.

20.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow. Intimal thickening distally (< 25% stenosis).

ECA- Slightly raised velocities. Mild ECA stenosis.

ICA- Raised velocities. Calcified plaque proximally (50-69% stenosis).

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow. Intimal thickening distally (< 25% stenosis).

ECA- Normal flow.

ICA- Normal flow. Mixed plaque proximally (25-49% stenosis).

VA- Normal antegrade flow.

21.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Some reduction in flow. Soft plaque in the bifurcation (< 25% stenosis).

ECA- Normal flow.

ICA- Raised velocities. Mixed plaque proximally extending for 2 cm from the origin (> 70% stenosis). Bifurcation lies 7 cm below the ear lobe.

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow. Intimal thickening distally (< 25% stenosis).

ECA- Normal flow.

ICA- Normal flow. Mixed plaque proximally (< 25% stenosis).

VA- Normal antegrade flow.

22.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow. Mixed plaque at the origin (< 25% stenosis).

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow. Calcified plaque at the bifurcation (25-49% stenosis).

ECA- Normal flow.

ICA- Normal flow. Calcified plaque proximally (25-49% stenosis).

VA- Normal antegrade flow.

23.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow. Intimal thickening proximally (< 25% stenosis).

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow. Intimal thickening proximally (< 25% stenosis).

VA- Normal antegrade flow.

24.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow.

VA- Normal antegrade flow.

RIGHT

CCA- Normal flow.

ECA- Normal flow.

ICA- Normal flow. Intimal thickening proximally (< 25% stenosis).

VA- Normal antegrade flow.

25.

DUPLEX ULTRASOUND SCAN OF THE CAROTID AND VERTEBRAL ARTERIES

(ICA stenosis values are based on NASCET criteria)

LEFT

CCA- Normal flow. Mixed plaque distally (25-49% stenosis).

ECA- Normal flow. Calcified plaque proximally (25-49% stenosis).

ICA- Normal flow. Mixed plaque proximally (<25% stenosis).

VA- Normal antegrade flow

RIGHT

CCA- Normal flow. Soft plaque distally (25-49% stenosis).

ECA- Normal flow.

ICA- Normal flow. Soft plaque proximally (<25% stenosis).

VA- Normal antegrade flow.

# Protocols

## YGC Vascular Laboratory

YGC VASCULAR LABORATORY PROTOCOLS .

1. Carotid Duplex.
2. Lower Limb Arterial
3. Lower Limb Venous
4. Upper Limb Arterial
5. Upper Limb Venous
6. Renal Access
7. Graft Surveillance
8. AAA Surveillance
9. EVAR Surveillance
10. Mesenteric Artery Duplex
11. Ankle Brachial Pressure Index
12. Miscellaneous Examinations

Pt Preparation for All Examinations: Check pt details- name, DOB, address.

Change into gown if necessary, take relevant history, explain procedure and obtain verbal consent to proceed.

NB: For all male patients > 50 years age: Check imaging history on Radis and offer/ perform AAA screening, unless AA has been reported as normal in previous 5 years.

1. **Carotid Duplex:**

Indications: TIA, Stroke, Amaurosis Fugax & other Visual Disturbances. Horner’s Syndrome. Pre-op Cardiac Surgery.

Preparation: None needed. Remove jewellery from neck, adequate access to neck required.

U/S Machine initialized to Carotid pre-set. Probe used- L12-3 MHz ( Philips Epiq 5); eL18-4 MHz

Pt lies comfortably on couch, face up, head end raised as per comfort/ breathing requirements.

Head turned slightly away from side being examined, care taken with pts with spinal problems.

For each major artery:

Note made and images recorded of any focal / significant plaque, anatomical variants, or extra-anatomical structures.

Doppler interrogation performed, firstly using colour flow, if normal, pulsed Doppler spectral analysis performed, with samples taken and recorded in proximal, mid and distal portions. Peak systolic and diastolic velocities measured and recorded, care taken in using a Doppler angle of

< / = 60 degrees.

The CCA is examined in longitudinal and transverse sections from its origin

( if possible ) to its bifurcation.

The ICA is positively identified anatomically- no major branches in the extra-cranial portion.

The ECA is positively identified anatomically, by identifying branches above its origin.

Doppler spectral analysis performed, images recorded.

Vertebral artery identified, establish patency, and direction of flow- antegrade, retrograde, bi-directional.

(Rt Side) Innominate artery ( if visible); Subclavian artery examined in its proximal portion for patency and any abnormal Doppler signals.

Repeat for both sides.

Grading of ICA disease:

Normal.

Mild ( Intimal thickening/ calcification), normal Doppler signals.

< 50 % stenosis: Plaque present, normal Doppler signals.

50-59 % stenosis-]see link below for SVT guidelines.

60-69 % stenosis- ] “” “” “” “” “” “”

70-79 % stenosis- ]

80-89 % stenosis-]

> 90 % stenosis.]

Near-Occlusion. ]

Occlusion. ] “” “” “” “” “”

Write report on Radis, print, check, sign and send to the referring clinician.

NB: If a surgically significant stenosis is detected, advise referring clinician that vascular referral is indicated. Note in diary for f/up. If possible re-scan on day of surgery.



<https://www.svtgbi.org.uk/media/resources/Carotid_PPG.pdf>

**2 : Lower Limb Arterial Duplex:**

Indications: Intermittent claudication, rest pain, ulcers, gangrene, acute ischaemia.

Pt preparation. 8 Hours prior fasting if not diabetic. Light meal with medications if diabetic.

Removal of trousers etc, change into pt gown if necessary.

Lie pt on their back on couch, head slightly up if required.

Use Abdominal Vascular Pre-set.

Using curved abdominal C5-1 probe, commence in upper abdomen, assess abdominal aorta for size, ie exclude aneurysmal disease, assess patency using colour flow.

Assess common and external iliac arteries, exclude aneurysmal disease and assess patency using colour flow and pulsed wave Doppler.

Identify internal iliac artery origin if possible, exclude any aneurysmal changes.

Using linear L12-3 probe commence at CFA, try to visualise the inferior epigastric artery ( IEA) to localise the level of the inguinal ligament.

Scan in longitudinal plane using b-mode and colour flow to assess anatomy, plaque, and localise flow disturbance for pulsed wave spectral analysis.

Assess, CFA, PFA origin, SFA and proximal Popliteal A.

If mobile turn pt to assess the popliteal, TPT and peroneal arteries.

Lie pt flat to assess ATA and PTA to the ankle.

Note and document plaque, stenosis ( see below for grading), occlusion

(measures its length if possible).

Repeat for other side if bilateral examination.

NB: If single leg examined: Check contra-lateral iliac arteries and CFA, if significant disease present on symptomatic side, to aid possible endo-vascular interventions.

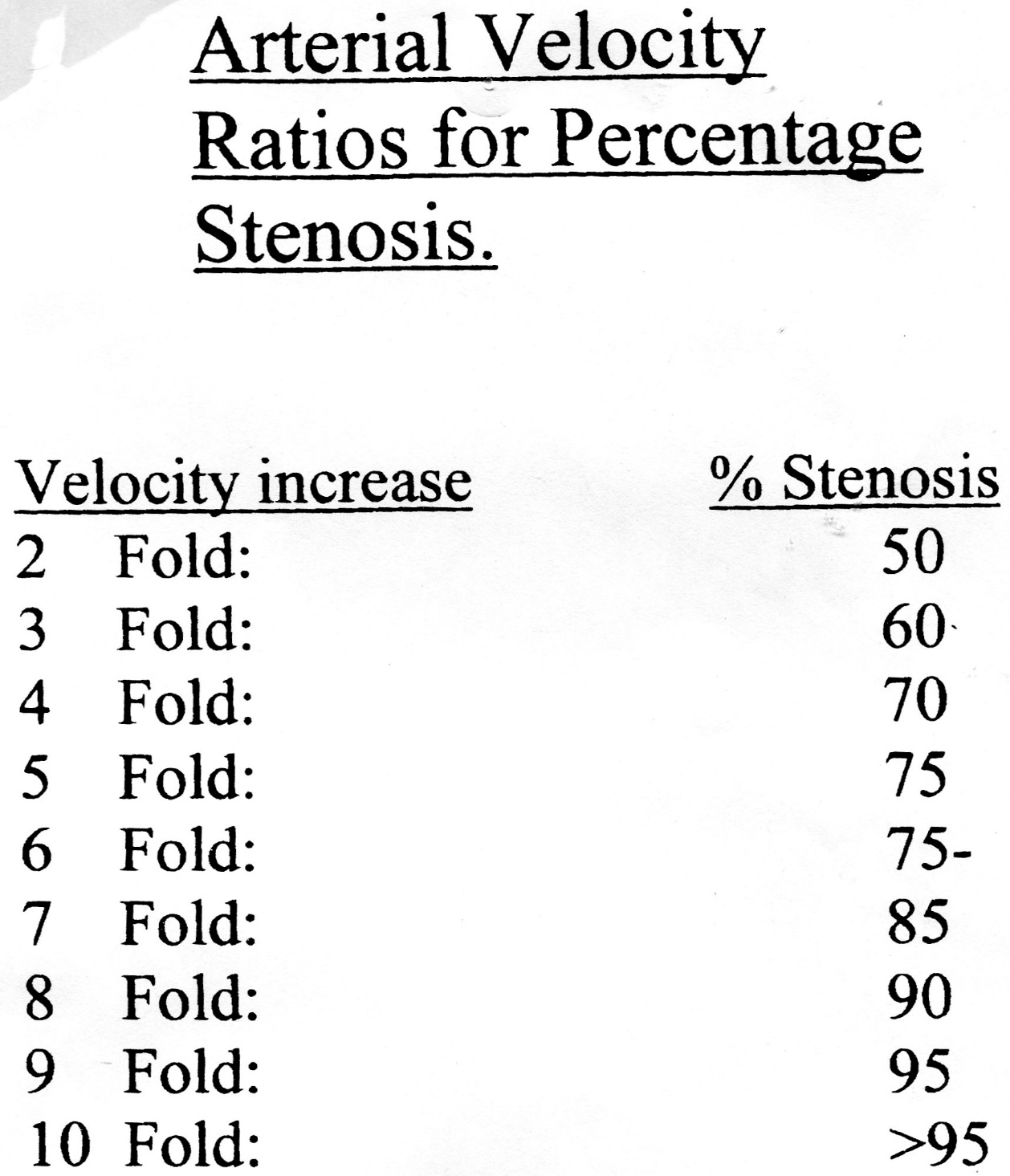
If pt is likely to need infra-inguinal bypass surgery, assess ipsilateral LSV for suitability.

Popliteal aneurysms- check both sides, and also AA & Iliac arteries.

Write report on Radis, create diagram using Genesis reporting software, store on secure server. Attach report diagram ( s ) to PACS as an extra document.

Send paper copies to referring clinician.

<https://www.svtgbi.org.uk/media/resources/LLA_PPG.pdf>



**3 Lower Limb Venous:**

Indications: VV, Venous insufficiency. Ulcers. Pre-op Fem-Pop bypass.

Pt Prep: Removal of trousers etc.

Pt lies on couch, foot on step, the couch is tilted to approx 45 deg.

Select Venous pre-set protocol,. Use L12-3 probe; eL18-4/ L18-5.

Deep veins- assess in transverse section, using compression to check patency in the CFV, SFV and Popliteal V. Using colour flow to determine competency, using inspiration, calf compressions, Val Salva as appropriate. Use pulsed Doppler if colour impression is indeterminate for competency, > 0.5 sec of reversed flow ( reflux) consistent with incompetence.

Assess the LSV from the Sapheno-femoral junction, noting patency, size, branches, perforator connections.

Competence assessed using colour and pulsed wave Doppler , > 0. 5 sec reversed flow consistent with significant reflux.

Assess SSV for patency and competence from the sapheno-popliteal junction, noting any anatomical variants, eg high/ low origin, Giacomini vein etc.

Note any thrombus- acute/ chronic.

Comment if suitable for Endo-venous procedure: Diameter of lumen >/= 3 mm; not tortuous, no chronic post-thrombotic changes.

Write report on Radis, create Genesis report. Send reports to referring clinician.

<https://www.svtgbi.org.uk/media/resources/Venous_Reflux_PPG.pdf>

Vein Mapping ( Prior to Fem-pop bypass).

Assess deep vein patency as per Protocol for Lower Limb Venous.

Use Venous pre-set; Select higher frequency probe (eL18-4/ L18-5).

Assess LSV for competency, and measure lumen. < 2.5- 3 mm usually suitable for bypass.

Note branches, perforators, course- superficial, lateral etc.

On the day- re-scan & map LSV and mark course with an indelible pen.

**4: Upper Limb Arterial.**

Indications: Acute ischaemia, including post Cardiac Catheterisation ? pseudo-aneurysm; Chronic ischaemia- ulcers. Arm pain, Cold intolerance

( Raynauds). ? Thoracic Outlet syndrome, VWF. ? AVF

Pt Prep: Removal of clothes from upper body, removal of jewellery.

Lie pt on couch, may be easier to perform forearm assessment sitting. Ergomically easier to have relevant side closest. ( Flip couch for Rt & Lt Arms).

Select Arterial pre-set, using L12-3 probe. May need to use Curved C5-1 for proximal vessels and eL18-4/ L18-5 for forearm vessels.

NB Examination should include a Carotid/ Vertebral artery assessment.

Scan from proximal innominate/ subclavian artery ( if possible), examine subclavian, axillary, brachial. Radial and ulnar arteries throughout their course. Take samples and document any stenoses, occlusions.

Create Genesis diagram if appropriate.

Thoracic Outlet Syndrome: Refer VLP Volume 5 for positional techniques to provoke impingement.

<https://www.svtgbi.org.uk/media/resources/UpperLimbArterialFINALJuly2015Edit.pdf>

**5: Upper Limb Venous Assessment:**

Indications: ? DVT. ? Superficial venous thrombosis.

Use Venous pre-set; select L12-3 probe.

Examine supine/ head down to distend the superior veins, sitting for the arm veins.

Use colour flow proximally, compression in the arm to determine patency.

Examine jugular, brachio-cephalic, subclavian, axillary, brachial radial and ulnar veins.

Examine Cephalic and Basilic veins, if thrombosed, follow to their deep vein confluence to exclude/ confirm deep venous involvement.

<https://www.svtgbi.org.uk/media/resources/UpperLimbVenousProtocolJuly2015edit.pdf>

**6: Renal Access.**

Pre- AVF. Performed sitting on couch/ chair/ wheelchair, arm( s ) dependent.

Ensure room and gel are warm.

Check and document which arm is dominant

Venous Assessment.

Use Venous pre-set; select high frequency (eL18-4/ L18-5) probe.

Place tourniquet on superior upper arm. Encourage pt to make a fist several times.

Commence at the wrist. Locate, and measure Cephalic vein from wrist to upper arm/ tourniquet level.

Note any branches, duplication, unusual course.

Locate and measure Basilic vein in the upper arm.

Check deep veins in the upper arm. If previous central line, ? check subclavian vein.

Arterial Assessment:

Use Arterial Pre-set; eL18-4/ L18-5 probe, may need a lower frequency

( L 12-3) in the upper arm.

Scan Radial and Ulnar arteries from wrist to elbow/ brachial bifurcation. Assess patency, calcification.

Assess brachial artery, also check on transverse section if it has a high bifurcation. If abnormal Doppler signals in the Brachial/ Radial / Ulnar arteries, proceed superiorly to determine proximal patency/ stenosis/ occlusion.

<https://www.svtgbi.org.uk/media/resources/PreNativeUpperLimbArterioVenousFistulaFINALJuly2015edit.pdf>

AVF assessment:

Use Arterial Pre-set; eL18-4/ L18-5 probe, may need a lower frequency ( L 12-3) in the upper arm.

Scan inflow artery, measure velocities and volume flow 2-3 cm above the anastomosis.

Take Doppler recordings at the anastomosis and along the course of the fistula. Measure PSV, EDV and volume flows.

Note any stenoses, document location and effect on volume flow.

If AVF tightly stenosed or occluded- let referring team know asap.

<https://www.svtgbi.org.uk/media/resources/NativeUpperLimbArterioVenousFistulaFINALJuly2015edit_G03QDOt.pdf>

Pre-Transplant Assessment:

Examine AA, CIA, IIA origins, EIA and CFA- bifurcations for disease and / or flow disturbance. Comment if densely calcified.

Check iliac veins for patency.

**7 Graft Surveillance.**

Post iliac, femoral bypass. Intervals at surgeons’ discretion.

3/12 for first year, 6 /12 for following 2 years. (Re-start if intervention occurs).

Pt Prep- as for arterial duplex examination.

Aorto/ Ileo-fem bypass: Assess graft for patency, check for anastomotic dilatation, stenosis.

Scan infra-inguinal vessels- ankle as per arterial study.

Note if Vein- In-situ vs. reversed, or PTFE. ( Op notes most useful).

Fem-Pop. Assess iliac vessels if CFA waveform abnormal.

Assess anastomoses and entire length of graft.

Vein graft- pay close attention for any in-graft stenosis ( valve/ damaged sites with valvatome) as well as anastomoses.

In early scans note presence of seroma, haematoma etc.

If PTFE look for signs of infection- peri-graft thickening, fluid etc.

Assess vessels distal to the graft as per normal lower limb study.

**8 AAA Surveillance.**

Patient Prep: None. Open / raise shirt etc to expose lower 1/2 abdomen.

Select abdominal Vascular pre-set; C1-5 curvilinear probe.

Initially assess aorta for widest point.

Measure maximum AP diameter in longitudinal section.

Also measure in transverse diameter for reference, comment if ovoid vs circular.

Comment on first report if fusiform or saccular, inflammatory.

Comment in subsequent examinations if saccular or inflammatory changes are present, whether new or known.

Note iliac artery aneurysms, measure on any surveillance examination.

After examination, return referral to surveillance folder, in appropriate location as per surgeon’s protocols.

< 4 cm: 3-Yearly ; 4-4.9 cm- 12 monthly ; 5 cm or greater: inner AP diameter- 6 monthly.

If near to threshold or fast-growing ( > 1 cm/ year), 3 monthly.

When size reaches 5.5 cm comment that ongoing surveillance has finished, outcome awaited.

**9 EVAR Surveillance.**

Pt Prep: Fasting 8 hours prior.

Open / raise shirt etc to expose lower 1/2 abdomen.

Select abdominal C1-5 curvilinear probe, Vascular Abdominal machine pre-set.

Measure AP and transverse diameters ( outer).

Assess stent for patency, limbs for patency and distal iliac/ proximal femoral arteries for stenosis etc.

Using low velocity settings, assess sac in longitudinal and transverse for endo-leak. Try to establish entry and exit points.

Intervals at Radiologist ( Dr Rees) discretion.

At present, perform yearly scans for 5 years if no problems detected.

<https://www.svtgbi.org.uk/media/resources/EVARprotocolforPSCFinalJuly15edit_sSpc3A4.pdf>

**10: Mesenteric Artery Duplex Examination.**

Indications: Mesenteric Angina, Chronic Weight Loss.

Pt Prep: 12 hour fasting.

Recommend appointment first thing in the morning.

Avoid fizzy drinks.

Raise shirt to expose abdomen.

Use Abdominal- Vascular Pre-set; C1-5 Curvilinear probe.

Examine abdominal aorta in longitudinal and transverse section.

Identify Coeliac Axis origin, Superior Mesenteric Artery ( SMA ) origin, Inferior Mesenteric Artery (IMA) origin.

Determine patency, then obtain Doppler signals in the proximal aorta, Coeliac Axis origin and its major branches ( Hepatic and Splenic Arteries); SMA origin, IMA origin.

Record PSV and EDV values for each vessel at its origin, and if possible beyond its origin.

Stenosis criteria: As per SVT guidelines.

<https://www.svtgbi.org.uk/media/resources/Mesenteric_PPG_2018_eYGw8R0.pdf>

**11: Ankle-Brachial Pressure Index:**

Indication: Preliminary examination to confirm/ exclude lower limb PVD .

Preparation: Remove clothing to permit access to upper arms and ankles/ feet.

Technique: Pt lies supine for 5-10 mins.

Place BP cuff around arm nearest to examiner.

Using hand-held Doppler machine, locate Brachial artery pulse, then inflate BP cuff until it is obliterated. Note BP at which the Doppler signals are obliterated.

Repeat with other arm.

Move BP cuff to distal leg.

Locate PTA pulse, medial ankle, inflate cuff and observe BP required to obliterate pulse.

Repeat with ATA/ DPA pulse.

Repeat for the other leg.

Calculate ABPI: Highest Ankle BP / Highest arm BP.

<https://www.svtgbi.org.uk/media/resources/ABPI_at_rest_and_post_exerciseSept2015edit.pdf>

**12: Miscellaneous Examinations:**

For rarely-performed examinations, refer to the Relevant Chapters of the Vascular Laboratory Practice and relevant SVT Guidelines.

Resources: Vascular Laboratory Practice Parts1-5 IPEM

SVT website: <http://www.svtgbi.org.uk/professional-issues/>

YMH Vascular Laboratory

**PROCEDURE FOR DUPLEX ULTRASOUND EXAMINATION OF CAROTID AND VERTEBRAL ARTERIES**

**Purpose**

* To provide a standardised method of work for duplex scanning of carotid and vertebral arteries, which is up to date and in agreement with national recommendations.

**Scope**

* This applies to any Vascular Technologist or Sonographer working in the Vascular Laboratory.

**Client Group**

* Any Vascular Technologist or Sonographer performing carotid and vertebral artery duplex scanning, the referring consultants and the patients attending for the scan.

**Referrals**

* Referrals must be from a consultant.
* Patient must have been symptomatic with lateralising symptoms within the previous 6 months **OR** be suspected to have a carotid body tumour or aneurysm **OR** being worked up for a procedure which carries with it the risk of stroke (e.g. coronary artery bypass grafting).
* Referrals must be signed and dated
* Referrals must be legible
* NICE guidelines state that Carotid Duplex scans should be performed within 7 days of onset of symptoms. This is not always possible, but should be aspired to.

**Procedure**

* Relevant clinical history should be obtained from the patient
* The procedure will be explained to the patient and the patient made aware that the test should not hurt.
* The guidelines set out in ‘Vascular Laboratory Practice – Part 2 (Extra- and Intracranial arterial assessment)’ should be followed.
* Further procedures may be carried out should the practitioner performing the scan deem this to be necessary to complete the diagnostic picture. Examples of this include: Subclavian artery assessment in the presence of retrograde flow in the vertebral artery (i.e. subclavian steal syndrome) and assessment of the Aorta in the presence of a Carotid artery aneurysm (to rule out Aortic aneurysm).

**Interpretation**

* The guidelines set out in ‘Vascular Laboratory Practice – Part 2 (Extra- and Intracranial arterial assessment)’ should be followed.
* The ‘Joint Recommendations for Reporting Carotid Ultrasound Investigations in the United Kingdom’ should be used. These use the NASCET criteria for grading ICA stenoses.
* Internal carotid peak systolic velocity should be the primary method for grading >50% stenosis, using ICA:CCA velocity ratios for confirmation. Consideration should also be given to the degree of stenosis suggested by the B-scan image. The St Mary’s ratio may be used if uncertainty still exists after using the other grading methods. The St Mary’s ratio should not be used when the CCA end diastolic velocity is <10cm/s.
* Stenoses of less than 50% may be estimated by the use of B-scan imaging. These should fall into the categories of less than 25% or 25-49%. If there is inadequate data from B-scan imaging these stenoses should simply be classified as less than 50%.
* Doppler angle should be kept as close to 60 degrees as possible (but should not exceed 60 degrees and not be below 45 degrees).
* Fibromuscular dysplasia should be considered as a differential diagnosis in isolated mid to distal Internal Carotid Artery stenosis.

**Reporting**

* This should be done using the RADis reporting package
* If a report is required quickly, then a provisional report may be handwritten
* Diagrams may be used to aid reporting. The fact that a diagram has been produced should be mentioned in the RADis report.
* The general guidelines set out in ‘Vascular Laboratory Practice – Part 1 (Basic physical principles)’ should be followed.
* The report must state that NASCET criteria have been used to grade ICA stenoses.

**References**

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**Wrexham Maelor Hospital**

**Procedure for performing Lower Limb Arterial Duplex Ultrasound Examinations**

This procedure is based on the guideline prepared by the Professional Standards Committee (PSC) of the Society for Vascular Technology (SVT). Suitable alterations and additions have been made to reflect requirements of local service users.

**Purpose**

Duplex ultrasound examination is used to assess the arteries of the lower limb (aorta to ankle level) to determine the location and severity of vascular disease (occlusive and aneurysmal).

**Scope**

This applies to any Clinical Vascular Scientist, Sonographer, or trainee working in the vascular laboratory.

**Client Group**

Any Clinical Vascular Scientist, Sonographer , or trainee performing duplex scanning of lower limb arteries, the referring consultants and the patients attending for the scan.

**Referrals**

* Referrals must be from a doctor or a health professional who has been granted the right to request these examinations
* The referral must give adequate clinical detail (such as: symptoms, risk factors, which pulses are present/absent, ankle-brachial pressure indices and which limb or limbs are to be examined).
* Referrals must be signed and dated
* Referrals must be legible

**Common Indications**

Common indications for the performance of this examination include:

 Intermittent claudication

 Ischemic rest pain

 Gangrene

 Ulceration

 Post surgical intervention follow-up e.g. angioplasty

 ?aneurysm

 ?false aneurysm

**Contraindications and Limitations**

Contraindications for lower limb arterial duplex ultrasound assessment are unlikely; however, some limitations exist and may include the following:

 Obesity

 Casts, dressings, open wounds etc.

 Bowel gas when examining the aorto-iliac segment

 Patients who are unable to cooperate due to reduced cognitive functions e.g.

Alzheimer’s or dementia and through involuntary movements

**Equipment:**

Duplex Doppler ultrasound machine with imaging frequencies of 3.5MHz and greater; with both linear and curvilinear transducers available. Doppler frequencies of at least 3.0MHz should be available, with colour Doppler capability.

Compliance with the Medical Devices Directive is necessary. Electrical safety testing is required annually, with regular maintenance and quality assurance testing to specified level by qualified personnel. Review of in-service equipment should typically be undertaken four - six years after installation1.

Examination couch should be height adjustable preferably electrical. The CVS’s chair should provide good lumbar support, be height adjustable and allow for the CVS to move close to the examination couch2 3.

The examination room should be temperature controlled with adjustable lighting levels suitable for examination5.

**Explanation of examination and patient history:**

The CVS undertaking the examination should:

* introduce themselves
* confirm the patient’s identity e.g. full name and date of birth
* explain why the examination is being performed
* give an explanation of the procedure and its duration – consideration should be made to the age and mental status of the patient
* obtain verbal consent for the examination
* obtain a pertinent relevant medical history from the patient and/or notes
* Presence of risk factors

Smoking

Hypercholesterolemia

Hypertension

Diabetes

o Results of other relevant diagnostics & previous vascular studies

**Examination:**

The examination may be unilateral or bilateral dependent upon clinical symptoms.

The patient is asked to remove their clothing to expose the lower limb from groin to ankle. The patient is examined supine.

The patient’s dignity and privacy should be maintained at all times. Due to the intimate nature of the examination, it may be considered necessary to offer a chaperone4

During the examination the patient’s mental and physical status should be monitored and modifications made to the examination accordingly.

Ankle brachial pressure index (ABPI) may be recorded as a baseline, however this is often done in the vascular clinic prior to the examination being requested.

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

* B-mode should be used to image the artery and assess for aneurysmal dilation and vessel contents e.g. atheromatous plaque
* Spectral Doppler should be used to determine direction of flow, stenotic flow and absence of flow
* Colour Doppler should be used to assess for the presence/absence of flow and aid the position of spectral Doppler when quantifying stenoses.

Evaluation of the following arteries should be included:

* Aorta \*
* Common iliac artery (CIA) \*
* External iliac artery (EIA) \*
* Common femoral artery (CFA)
* Proximal profunda femoris artery (PFA)
* Superficial femoral artery (SFA)
* Popliteal artery
* Tibio-peroneal trunk (TPT)
* Posterior tibial artery (PTA)
* Peroneal artery
* Anterior tibial artery (ATA)

Examination of the Aorta, CIA and EIA may be eschewed in the following circumstance:

1. There is normal (non-damped) triphasic flow in the CFA.
2. There is no clinical suspicion of Aortic aneurysm
3. There is no buttock or thigh claudication
4. There is no suspicion of embolic disease

**Interpretation**

* The guidelines set out in ‘Vascular Laboratory Practice – Part 3 (Lower limb arterial assessment)’ should be followed.
* Severity of stenosis should be determined by systolic velocity ratios. Where this is not possible, absolute systolic velocities, observing changes in waveform characteristics and/or Pulsatility Index may be used with caution.
* Various studies have recommended peak systolic velocity ratios ranging from 3:1 to 4:1 for diagnosing 70% stenosis in lower limb arteries. Certainly 70% stenosis should be considered at 3:1 ratio, but would need to take into account B-mode images, turbulence and damping of waveforms distal to the site (3:1 ratio is more likely to be suggestive of 50-69% stenosis). A 4:1 ratio should be deemed to give a more definite likelihood of 70% stenosis.
* The size and extent of any aneurysms or ectatic arteries must be documented.

**Reporting:**

* This should be done using the RADis reporting package
* If a report is required quickly, then a provisional report may be handwritten
* Diagrams may be used to aid reporting. The fact that a diagram has been produced should be mentioned in the RADis report. A template for diagrams is available in the Vascular Laboratory.

The report is a recording and interpretation of observations made during the lower limb arterial duplex ultrasound examination; it should be written by the CVS undertaking the examination and viewed as an integral part of the whole examination5.

The report should include correct patient demographics; date of examination; examination type and the name of the CVS.

The reporting should include:

* Which arteries have been assessed commenting on the waveforms or presence/absence of flow
* The anatomical position and, if possible, length of any occlusions or stenoses e.g. *x* cm in length starting *y* cm above the medial femoral condyle
* The anatomical position and size of any aneurysms
* Any limitations e.g. difficult examination due to body habitus
* An appropriate number of annotated images that represent the entire ultrasound examination - in accordance with local protocols and SVT Image Storage Guidelines5

Ensure appropriate efficient referral of critical ultrasound results to the referring consultant are made prior to the patient being discharged so treatment plans can be enforced or expedited accordingly.

**RESOURCES:**

Society for Vascular Ultrasound Vascular Technology Professional Performance Guidelines Lower Limb

Extremity Venous Duplex Evaluation 2011 www.svunet.org

American Institute of Ultrasound in Medicine Practice Guideline for the Performance of Peripheral Venous

Ultrasound Examinations 2010 www.aium.org

Australasian Society for Ultrasound in Medicine Policies and Statements D20 Peripheral Venous Ultrasound

2007 www.asum.com.au

**REFERENCES:**

1 Standards for Ultrasound Equipment Royal College of Radiologists, February 2005 www.rcr.ac.uk

2 Guidelines for Professional Working Standards Ultrasound Practice United Kingdom Association of

Sonographers (UKAS) October 2008 www.sor.org/learning/document-library

3 The Causes of Musculoskeletal Injury Amongst Sonographers in the UK Society of Radiographers, June 2002 www.sor.org/learning/document-library

4 Society for Vascular Technology Professional Standards Committee Chaperone Guidelines April 2012 www.svtgbi.org.uk

5 Society for Vascular Technology Professional Standards Committee Image Storage Guideline April 2012 www.svtgbi.org.uk

1. Last updated 21.03.2018 [↑](#footnote-ref-1)