**Carotid portfolio**

**Patient 1 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 65cm/s CCA EDV\*\*=13cm/s

ICA PSV= 95cm/s ICA EDV=21cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Mild atheroma seen in the proximal ICA but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 70cm/s CCA EDV\*\*=15cm/s

ICA PSV= 60cm/s ICA EDV=14cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 2 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 120cm/s CCA EDV\*\*=13cm/s

ICA PSV= 50cm/s ICA EDV=12cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA and bulb but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 89cm/s CCA EDV\*\*=15cm/s

ICA PSV= 62cm/s ICA EDV=20cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 3 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Small calcified plaques seen in ECA and proximal ICA but no haemodynamically significant.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 68cm/s CCA EDV\*\*=12cm/s

ICA PSV= 62cm/s ICA EDV=15cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Small calcified plaques seen in the ECA and burfication but no haemodynamically significant.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* =71 cm/s CCA EDV\*\*=10cm/s

ICA PSV= 56cm/s ICA EDV=19cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 4 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Mild atheroma seen in distal CCA.

Distal extracranial ICA is tortuous.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* =75 cm/s CCA EDV\*\*=24cm/s

ICA PSV= 69cm/s ICA EDV=25cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* =90 cm/s CCA EDV\*\*=23cm/s

ICA PSV=63 cm/s ICA EDV=26cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 5 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 82cm/s CCA EDV\*\*=20cm/s

ICA PSV= 65cm/s ICA EDV=17cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 115cm/s CCA EDV\*\*=15cm/s

ICA PSV= 105cm/s ICA EDV=15cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 6 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* =83 cm/s CCA EDV\*\*=24cm/s

ICA PSV= 75cm/s ICA EDV=26cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 119cm/s CCA EDV\*\*=26cm/s

ICA PSV= 56cm/s ICA EDV=19cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 7 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* =104cm/s CCA EDV\*\*=24cm/s

ICA PSV= 67cm/s ICA EDV=21cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 101cm/s CCA EDV\*\*=28cm/s

ICA PSV= 56cm/s ICA EDV=23cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 8 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

An irregular calcified plaque seen in the bulb and extending in the proximal ICA but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 41cm/s CCA EDV\*\*=11cm/s

ICA PSV= 46cm/s ICA EDV=20cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

An irregular calcified plaque seen in the bulb and extending in the proximal ICA but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 33cm/s CCA EDV\*\*=10cm/s

ICA PSV=33cm/s ICA EDV=13cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 9 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* =146cm/s CCA EDV\*\*=16cm/s

ICA PSV= 97cm/s ICA EDV=21cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 125cm/s CCA EDV\*\*=20cm/s

ICA PSV= 70cm/s ICA EDV=20cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 10 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 39cm/s CCA EDV\*\*=11cm/s

ICA PSV= 50cm/s ICA EDV=10cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* =40cm/s CCA EDV\*\*=10cm/s

ICA PSV= 40cm/s ICA EDV=10cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 11 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A heterogeneous echogenic plaque seen in the proximal ICA but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 45cm/s CCA EDV\*\*=13cm/s

ICA PSV= 92cm/s ICA EDV=24cm/s

LEFT:

The CCA (origin not seen due to depth) and ECA are patent with no significant stenosis detected.

Reduced EDV in the CCA

**The entire extracranial ICA is occluded**

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 71cm/s CCA EDV\*\*=0cm/s

ICA PSV=N/A ICA EDV=N/A

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

**Clinical team informed**

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 12 U/S Carotid Doppler**

Challenging scan due to body habitats and depth of arteries

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A plaque seen in the proximal CCA but not haemodynamically significant

A calcified plaque seen in the proximal ICA but not haemodynamically significant

Vertebral artery shows high resistant antegrade flow suggesting significant distal disease.

Right

CCA PSV\* = 84cm/s CCA EDV\*\*=21cm/s

ICA PSV= 66cm/s ICA EDV=25cm/s

LEFT:

The CCA (origin not seen due to depth), ECA are patent with no significant stenosis detected.

There is a 80-89% (mixed echogenic) stenosis in the proximal ICA (2cm long) (however this could be tighter). Poor views of the mid-distal extracranial ICA but appears patent with normal low resistive flow.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 73cm/s CCA EDV\*\*=10cm/s

ICA PSV= 362cm/s ICA EDV=126cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity **Clinical team informed**

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 13 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A small mixed echogenic plaque seen in the proximal ICA but not haemodynamically significant

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 40cm/s CCA EDV\*\*=9cm/s

ICA PSV= 40cm/s ICA EDV=20cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 38cm/s CCA EDV\*\*=6cm/s

ICA PSV= 35cm/s ICA EDV=14cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 14 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 58cm/s CCA EDV\*\*=16cm/s

ICA PSV= 39cm/s ICA EDV=14cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 68cm/s CCA EDV\*\*=21cm/s

ICA PSV= 46cm/s ICA EDV=25cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 15 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A <50% irregular calcified stenosis seen in the proximal ICA but not haemodynamically significant.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 54cm/s CCA EDV\*\*=13cm/s

ICA PSV= 90cm/s ICA EDV=20cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 44cm/s CCA EDV\*\*=11cm/s

ICA PSV= 54cm/s ICA EDV=20cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 16 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 82cm/s CCA EDV\*\*=24cm/s

ICA PSV= 57cm/s ICA EDV=14cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 83cm/s CCA EDV\*\*=28cm/s

ICA PSV= 49cm/s ICA EDV=16cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS train

**Patient 17 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 108cm/s CCA EDV\*\*=20cm/s

ICA PSV= 47cm/s ICA EDV=16cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 87cm/s CCA EDV\*\*=22cm/s

ICA PSV= 40cm/s ICA EDV=17cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 18 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 76cm/s CCA EDV\*\*=9cm/s

ICA PSV= 46cm/s ICA EDV=9cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA but not haemodynamically significant

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 68cm/s CCA EDV\*\*=14cm/s

ICA PSV= 53cm/s ICA EDV=15cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 19 U/S Carotid Doppler**

Very challenging scan due to body habitas+++

RIGHT:

The CCA, ECA and proximal ICA are patent with no significant stenosis detected.

Unable to insonate/visualise the mid or distal ICA or innonate artery due to depth and body habitas+++ suggest alternative imaging if clinically needed.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 94cm/s CCA EDV\*\*=18cm/s

proximal ICA PSV= 68cm/s ICA EDV=8cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 104cm/s CCA EDV\*\*=0cm/s

ICA PSV= 75cm/s ICA EDV=25cm/s

ICA PSV normal limit <125cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity **Clinical team informed**

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 20 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the bifurcation but not haemodynamically significant

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 68cm/s CCA EDV\*\*=13cm/s

ICA PSV= 75cm/s ICA EDV=7cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA but not haemodynamically significant

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 66cm/s CCA EDV\*\*=9cm/s

ICA PSV= 99cm/s ICA EDV=21cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 21 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

Tortuous Distal ICA

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 88cm/s CCA EDV\*\*=19cm/s

ICA PSV= 63cm/s ICA EDV=18cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA but not haemodynamically significant

Tortuous Distal ICA

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 103cm/s CCA EDV\*\*=24cm/s

ICA PSV= 72cm/s ICA EDV=21cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 22 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the bifurcation but not haemodynamically significant

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 68cm/s CCA EDV\*\*=13cm/s

ICA PSV= 75cm/s ICA EDV=7cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA but not haemodynamically significant

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 66cm/s CCA EDV\*\*=9cm/s

ICA PSV= 99cm/s ICA EDV=21cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 23 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A irregular calcified plaque seen in the bifurcation and extending into the proximal ICA and ECA but not haemodynamically significant.

<50% calcified stenosis seen in the proximal ICA

The extracranial ICA is patent with high resistive/thump flow suggesting a distal occlusion.

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 79cm/s CCA EDV\*\*10cm/s

ICA PSV= 20cm/s ICA EDV=0cm/s

LEFT:

The CCA (origin not seen due to depth), ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the bifurcation and proximal ICA but not haemodynamically significant

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 77cm/s CCA EDV\*\*=20cm/s

ICA PSV= 102cm/s ICA EDV=25cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity **Clinical team informed**

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 24 U/S Carotid Doppler**

RIGHT:

The CCA is patent with no significant stenosis detected.

>50% stenosis seen in the proximal ECA.

This a mixed echogenic plaque is causing a 70-79% stenosis (measuring 0.65cm long) in the proximal ICA. The mid-distal extracranial ICA is patent with normal low resistive flow.

Retrograde flow seen in the Vertebral artery.

Unable to visualise the innominate or proximal subclavian due to depth. The distal subclavian artery is patent with monophasic waveform.

Right

CCA PSV\* = 56cm/s CCA EDV\*\*=13cm/s

ICA PSV= 246cm/s ICA EDV=60cm/s

LEFT:

The CCA (origin not seen due to depth) and ICA are patent with no significant stenosis detected.

A mixed echogenic plaque seen in the bifurcation but not haemodynamically significant

>50% stenosis seen in the proximal ECA

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 47cm/s CCA EDV\*\*=14cm/s

ICA PSV= 103cm/s ICA EDV=31cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

**Clinical team informed**

Scanned and reported by Mervyn Mckenna AVS trainee

**Patient 25 U/S Carotid Doppler**

RIGHT:

The CCA, ECA and ICA are patent with no significant stenosis detected.

A small calcified plaque seen in the proximal ICA but not haemodynamically significant

Vertebral artery normal antegrade flow.

Right

CCA PSV\* = 67cm/s CCA EDV\*\*=17cm/s

ICA PSV= 61cm/s ICA EDV=18cm/s

LEFT:

The CCA (origin not seen due to depth) and ECA are patent with no significant stenosis detected.

Mild atheroma seen in the mid CCA but not haemodynamically significant

There is an echolucent (Soft) >90% stenosis but less then near occlusion seen in the proximal ICA. The mid-distal extracranial ICA is patent with normal low resistive flow.

Vertebral artery normal antegrade flow.

Left

CCA PSV\* = 51cm/s CCA EDV\*\*=14cm/s

ICA PSV= 467cm/s ICA EDV=244cm/s

ICA PSV normal limit <125cm/s

ICA EDV normal limit <40cm/s

\*PSV= peak systolic velocity

\*\*EDV= end diastolic velocity

**Clinical team informed**

Scanned and reported by Mervyn Mckenna AVS trainee

## Description: foundationlogocol

## Vascular Laboratory Guidelines

# Carotid Duplex Scan

**Patient Preparation:**

Check patient’s identification (2 forms of i.d)

Explain test procedure

Obtain verbal consent or implied consent (if patient gets undressed / lies down for scan)

Take relevant history from patient

Ask patient to undress as appropriate and remove jewellery if necessary.

**Scanner Preparation:**

The probes should be cleaned with Clinell wipes (green packet) after each patient. If a patient is infections, all staff should follow the Trust’s guidelines/policy on infection control. For infectious patients the cleaning of the ultrasound room should be done as outline in the form shown in appendix A. This form should be signed and kept in the department for audit purposes. The scanners and probes must be cleaned to the manufacturer’s guidelines.

**Procedure:**

1. Scan ideally performed with the patient lying supine, the patient’s head turned and the neck extended.
2. The accessible length of the common carotid artery (CCA), internal carotid artery (ICA), the proximal external carotid artery and a segment of the vertebral artery are examined using B-mode, colour flow imaging and spectral Doppler bilaterally. It is necessary to assess and compare the arteries on each side in order to account for any collateral flow effects.
3. The peak systolic velocity (PSV) and end diastolic velocity (EDV) should be recorded from the distal CCA (within 2cm of the bifurcation at a point where the vessel still has uniform diameter) and the ICA at the location where the highest PSV is seen.
4. The highest PSV in the diseased ICA will be seen at the point of tightest stenosis or in the jet immediately distal to the stenosis.
5. All velocity measurements should be made with the vessel in longitudinal section, the centre-line velocity measured and the correct Doppler gain.
6. The Doppler angle should be 45-60° with proper correction/calibration applied using the angle correction cursor. In the case of a tortuous vessel the cursor should be aligned to the tangent of curvature at the measurement point. In the case of the eccentric jet within a stenosis the angle cursor should be aligned to the jet.
7. For investigation of Carotid Body Tumour, often suggested by abnormal hormone levels or activity (i.e. catecholamins), image both carotid bifurcations. Note any hypervascular formation seen nestled in or surrounding the bifurcation. If a mass is seen splaying the ICA and the ECA, but no colour flow signal is obtained, adjust the PRF to enable detection of any low velocity flow within the mass.

**Criteria for classification of stenosis:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Percentage**  **Stenosis (NASCET)** | ICA PSV\* (cm/s) | ICA EDV\* (cm/s) | ICA PSV/CCAPSV \* | ICAPSV/CCAEDVc+  (St Mary’s Ratio) |
| <50 | <125a | <40 | <2a | <8 |
| 50-59 | >125a | 40-100 | 2-4a | 8-10 |
| 60-69 | 11-13 |
| 70-79 | >230a | >100 | >4a | 14-21 |
| 80-89 | 22-29 |
| >90 but less than near occlusion | >400b | >5b | >30 |
| Near occlusion | High, low–string flow | Variable | Variable | Variable |
| Occlusion | No flow | Not applicable | Not applicable | Not applicable |

* a Grant et al 2003
* b Filis at al 2002
* c Nicolaides et al 1996
* \* Primary Parameters, + Additional Parameters

Disease of less than 50% may be graded using the B-mode and colour flow imaging. An approximation of the diameter reduction may be given.

**Limitations of the criteria:**

1. Large plaques in large bulbs (e.g. >10mm diameter) but with a good residual lumen may still be a significant risk factor for embolic events. If this is the case than the bulb diameter and plaque thickness can be measured, noting that there is a good residual lumen.
2. An irregular heartbeat makes the velocity measurements less reliable. Where possible, the velocity should be measured on the second or subsequent cardiac cycle of a string of consecutive regular cycles.
3. Potential sources of variability in the ICA PSV:
   1. Variation in the geometry of the bifurcation and the size of the bulb (Schuluz and Rothwell, 2001a)
   2. Variation in the vessel size that reflects body size (Schuluz and Rothewell, 2001b)
   3. Collateral flow effects (Henderson et al, 2000 and Ray et al, 2000)
   4. Change in ICA flow over the menstrual cycle (Krejza et al, 2001)
   5. Change with age and blood pressure (Spencer et al, 2001)
   6. The physical parameters of the ultrasound machine (Hoskins 1999)

The effect of these factors on blood velocities in diseased vessels is mitigated by the use of velocity ratios.

1. Where there is bilateral zero or retrograde end-diastolic flow in the CCA (possible aortic valve disease) the St Mary’s ratio should not be used.
2. Where there is bilateral reduction in diastolic flow, there may be reduced vessel wall compliance due to arteriosclerosis, the St Mary’s ratio should not be used.
3. Where there is moderate to severe disease on one side and severe disease on the contralateral side, velocities tend to overestimate the stenosis on the less severe side as the vessel is acting as a collateral.
4. Inadequate visualisation – this should be recorded in the report and an alternative imaging modality recommended.
5. Unusual waveforms that may suggest inflow or outflow problems.

**Report:**

The report should include velocity measurements made in the CCA and ICA which are used to quantify degree of narrowing using the criteria above. The location of atheroma should be noted. In the presence of >70% stenosis, the absence of a normal calibre patent ICA distal to the stenosis should be highlighted.

Written reports will be available on Rad Centre/PACS. Diagrams can be drawn in complex cases and where they add value to the report. These diagrams will be scanned onto electronic medical records (EMR). However General Practitioners (GP) cannot access EMR to review diagrammatical results, therefore, the scan results should be a written report on RADCentre/PACS.

If a >70% stenosis is identified during an inpatient scan, the referring doctor or ward should be informed. If a >70% stenosis is identified during an outpatient scan, a copy of the report or outcome should be emailed to the referring consultant.

If during the scan there is an incidental finding that is serious and unexpected then at the bottom of the report the following caption should be added: [ALERT]

**Recommended images to be stored on PACS:**

* Spectral Doppler image of waveform velocities in bilateral CCA
* Spectral Doppler image of waveform in bilateral ECA
* Spectral Doppler image of waveform velocities in bilateral ICA
* Spectral Doppler image of waveform in bilateral vertebral artery
* If stenosis is present, store images of highest velocity detected within / post stenosis
* If stenosis is present, store B-mode and colour flow images of plaque
* Store images of any other relevant pathology detected
* Nb. In a one-stop clinic environment where time is limited, it may be difficult to record all of the above images

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