**CAROTID ARTERY IMAGING**

1. **SCOPE & OBJECTIVE**
   1. Extracranial carotid artery duplex to assess presence of pathology and haemodynamic status of the common carotid (CCA), internal carotid (ICA), external carotid (ECA) and vertebral artery.
   2. To provide operators with guidance on how to undertake the investigation.
2. **Responsibility**
   1. The Clinical Scientist (or trainee clinical scientist) performing the scan is responsible for undertaking the procedure.
   2. The Clinical Scientist (or trainee under supervision) may alter the procedure depending on individual patient and clinical information requirements.
   3. The chaperone/clinical scientist or trainee is responsible for undertaking the patient identification (DOB, Address or postcode)
   4. The Clinical Scientist (or trainee Clinical scientist) is responsible for ensuring sterile gel is used in situations outlined in the Infection Prevention Practice SOP.
3. **Imaging Procedure**
   1. Confirm patient identifiers (Name, DOB and Address) and introduce themselves. Explain the scan procedure and obtain informed consent ([trust consent policy](https://nhswales365.sharepoint.com/:b:/r/sites/CAV_Controlled%20Document%20Library/Shared%20Documents/Policies/Consent%20Policy%20final%20201119%20v2%20-%20Copy.pdf?csf=1&web=1&e=v6ubXr)). Obtain clinical history if necessary or check symptoms agree with the request form.
   2. This is not normally an intimate procedure but if deemed so, then a chaperone can be present in the room at the time of the investigation.
   3. The patient is asked to adjust their clothing to expose the neck area. Tissue should be tucked in to protect the patients clothing. The patient is asked to lie supine with their head in an appropriate position. Patient dignity should be maintained at all times.
   4. If the patient is immobile, the scan may be performed with the patient in the wheelchair.
   5. Select the patient details up on the machine and select the carotid pre-set.
   6. Use B-mode, colour Flow and triplex modes as necessary, to identify the CCA, ICA and ECA. Image the common carotid artery (CCA), internal and external carotid arteries (ICA/ECA) in transverse view (TS) using B-mode. B-mode can be used to classify echogenicity of any plaque and the characteristics e.g. smooth or irregular, calcified, homogenous or heterogenous and ulcerated (1).
   7. Using a longitudinal view with colour and spectral Doppler, the CCA, ICA, ECA and vertebral artery should be assessed for areas of raised velocity/occlusion. The vertebral artery should also be assessed for signs of subclavian steal syndrome.
   8. Use triplex mode (and dynamic flow/power Doppler if necessary) to examine CCA, ICA and ECA waveforms and measure the maximum PSV and EDV in each vessel.
   9. As a minimum, an image of the CCA and ICA in longitudinal plane with colour and spectral Doppler to demonstrate patency and PSV should be saved where possible.
   10. Determine stenoses using B-mode, colour and spectral Doppler (and dynamic flow/superb microvascular imaging when appropriate). Characterise haemodynamically significant stenoses using the following criteria (table 1) and B-mode assessment (PSV as primary index, PSV ratio as secondary index) (2).

Table 1: Carotid artery stenosis grading criteria

| Percentage stenosis (NASCET) | Internal carotid peak systolic velocity cm/sec | Peak systolic velocity ratio ICA PSV/CCA PSV |
| --- | --- | --- |
| <50 | <125 | <2 |
| 50–59 | >125 | 2–4 |
| 60–69 |
| 70–79 | >230 | >4 |
| 80–89 |
| >90 but less than near occlusion | >400 | >5 |
| Near occlusion | High, low – string flow | Variable |
| Occlusion | No flow | Not applicable |

* 1. If a stenosis is present, determine the length of the stenosis and distance from origin if appropriate. Report whether the vessel is free from atheroma distally. If there is a high or low bifurcation make note of this in the report.
  2. Examine the patency of vertebral artery and check flow direction. If retrograde flow is seen (i.e. partial or complete subclavian steal), then check and comment on the waveform and patency of the subclavian artery.
  3. Repeat procedure bilaterally.
  4. At the end of the scan give the patient some paper tissue to remove gel and inform them of the results. Inform them that the scan report will be available on the reporting system for the referrer to access.
  5. End exam and send images to PACS.

1. **Images and Reporting**
   1. End the exam on the machine to send images to PACS
   2. This is a dynamic scan and any images saved are not representative of the full scan performed. All images that are saved should be used to evidence diagnosis and aid reporting. The images alone should not be used to retrospectively diagnose
   3. For scans performed under ergonomically challenging conditions or with time constraints such as portable scans on the ward or within clinics a reduced set of images may be saved
   4. Record the name of any chaperone present in comments box on RADIS
   5. Complete the exam in RADIS
   6. If the patient is found to have a significant stenosis (>50%) either symptomatic or asymptomatic, or other pathology such as a dissection, then the vascular on-call reg or consultant of the week (COW) should be bleeped on 5214 for management advice.
   7. Note; patients referred for carotid artery scan for cardiac surgery work up will be followed up by cardiac and do not require bleep to vascular surgery (registrar or COW) regardless of disease burden. If the patient is reporting any TIA symptoms that could be related to significant carotid disease or there is any doubt, follow steps in 3.5.
   8. Note; if significant extracranial carotid disease is identified in an inpatient, then a bleep to vascular surgery (registrar or COW) is not required. Patient should be sent back to ward for follow up.
2. **References**
   1. European Carotid Plaque Study Group 1995 Carotid artery plaque composition – relationship to clinical presentation and ultrasound B-mode imaging. European Journal of Endovascular Surgery 10: 23-30 <https://pubmed.ncbi.nlm.nih.gov/21855017/>

Oates CP et al., Joint Recommendations for Reporting Carotid Ultrasound Investigations in the United [Joint recommendations for reporting carotid ultrasound investigations in the United Kingdom - PubMed (nih.gov)](https://pubmed.ncbi.nlm.nih.gov/19046904/)

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| --- | --- |
| **Scan type Between August and September 24.** | Report |
| 06/08/2024- Carotid duplex | RIGHT: Diffusely calcified extracranial carotid arteries. Not surgically significant. Poor views of the vertebral artery due to patient positioning. LEFT: Diffusely calcified extracranial carotid arteries. Not surgically significant. Normal antegrade vertebral flow. |
| 07/08/2024- Carotid duplex | BILATERAL: Minor calcification at the carotid bifurcation only. Otherwise normal extracranial carotid arteries. Normal antegrade vertebral flow. |
| 19/08/2024- Carotid Duplex | RIGHT: Mild calcification of the internal carotid artery only. Otherwise normal extracranial carotid arteries. Normal antegrade vertebral flow. LEFT: Normal extracranial carotid arteries on duplex ultrasound. Poor views of the vertebral artery however no obvious subclavian stenosis. |
| 19/08/2024- Carotid Duplex | BILATERAL: Normal extracranial carotid and vertebral arteries on duplex ultrasound. |
| 19/08/2024- Carotid duplex | RIGHT: Normal common carotid artery. Mild atheroma in the external carotid artery. Calcified plaque at the origin of the internal carotid artery causing 50-69% stenosis (PSV 151 cm/s). Normally positioned bifurcation and the extracranial carotid artery is free from atheroma distally. Normal antegrade vertebral flow. LEFT: Diffusely calcified extracranial carotid arteries. Not haemodynamically significant. Normal antegrade vertebral flow. |
| 19/08/2024- Carotid duplex | RIGHT: Mild calcification of the common and external carotid artery. Small calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 56 cm/s). Normal antegrade vertebral flow. LEFT: Mild calcification of the extracranial carotid arteries. Normal antegrade vertebral flow. |
| 19/08/2024- Carotid duplex | RIGHT: Normal extracranial carotid and vertebral arteries on duplex ultrasound. LEFT: Mild calcification of the extracranial carotid arteries. Normal antegrade vertebral flow. |
| 21/08/2024- Carotid duplex | RIGHT: Calcified common and external carotid arteries. Small irregular calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 71 cm/s). Not surgically significant. Normal antegrade vertebral flow. LEFT: Calcified common and external carotid arteries. Small irregular calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 74 cm/s). Not surgically significant. Normal antegrade vertebral flow. |
| 23/08/2024- Carotid duplex | RIGHT: Normal common and external carotid artery. Small calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 63 cm/s). Normal antegrade vertebral flow. LEFT: Mild calcification of the carotid bifurcation and origin of internal carotid artery only. Otherwise normal extracranial carotid arteries. Normal antegrade vertebral flow. |
| 28/08/2024- Carotid duplex | RIGHT: Normal common and external carotid artery. Small calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 63 cm/s). Normal antegrade vertebral flow. LEFT: Mild calcification of the carotid bifurcation and origin of internal carotid artery only. Otherwise normal extracranial carotid arteries. Normal antegrade vertebral flow. |
| 28/08/2024- Carotid duplex | BILATERAL: Mild calcification of the extracranial carotid arteries. Not surgically significant. Normal antegrade vertebral flow |
| 28/08/204- Carotid duplex | BILATERAL: Mild calcification of the extracranial carotid arteries. Not surgically significant. Normal antegrade vertebral flow |
| 29/08/2024- Carotid duplex | BILATERAL: Normal extracranial carotid and vertebral arteries on duplex ultrasound. |
| 29/08/2024- Carotid duplex | BILATERAL: Normal extracranial carotid and vertebral arteries on duplex ultrasound. |
| 30/08/2024- Carotid duplex | RIGHT: Mild atheroma in the common carotid. Stenosed external carotid artery. Enhanced velocities approx. 1cm from the origin suggesting 50-69% stenosis (PSV 156 cm/s). Normal antegrade vertebral flow. LEFT: Mild atheroma in the common carotid artery. Calcified origin of the external carotid artery. Irregular calcified plaque at the origin of the internal carotid artery with velocities suggesting 70-89% stenosis (PSV 261 cm/s). Normal antegrade vertebral flow |
| 30/08/2024- Carotid duplex | RIGHT: Mild atheroma in the common and external carotid arteries. Irregular calcified plaque at the origin of the internal carotid artery causing 70-89% stenosis (PSV 239 cm/s), distal to stenosis the vessel is free from atheroma. Normally positioned bifurcation. Normal antegrade vertebral flow. LEFT: Mild atheroma in the common and external carotid arteries. Irregular calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 96 cm/s). Not surgically significant. Normal antegrade vertebral flow |
| 30/08/2024- Carotid duplex | RIGHT: Mild atheroma of the extracranial carotid arteries on duplex ultrasound. Normal antegrade vertebral flow. LEFT: Mildly atheromatous common and external carotid arteries. Small calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 71 cm/s). Normal antegrade vertebral flow. |
| 02/09/2024- Carotid duplex | RIGHT: Mild atheroma of the extracranial carotid arteries. Not surgically significant. Poor views of the vertebral artery. LEFT: Mild atheroma in the common and external carotid artery. Smooth homogenous plaque approx. 1cm from the origin of the internal carotid artery causing enhanced velocities suggesting 70-89% stenosis (303 cm/s). Normal antegrade vertebral flow. |
| 10/09/2024- Carotid duplex | BILATERAL: Normal extracranial carotid and vertebral arteries on duplex ultrasound. |
| 11/09/2024- Carotid duplex | RIGHT: Mildly atheromatous extracranial carotid arteries. Not haemodynamically significant. Normal antegrade vertebral flow. LEFT: Mild calcification at the carotid bifurcation, otherwise mildly atheromatous extracranial carotid arteries. Not haemodynamically significant. Normal antegrade vertebral flow. |
| 13/09/2024- Carotid duplex | BILATERAL: Mild calcification of the extracranial carotid arteries, not haemodynamically significant. Normal antegrade vertebral flow. |
| 19/09/2024- Carotid duplex | BILATERAL: Minor calcification at the carotid bifurcation only. Otherwise normal extracranial carotid arteries. Normal antegrade vertebral flow. |
| 19/09/2024- Carotid duplex | RIGHT: Normal common carotid artery. Mildly calcified external iliac artery. Small calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 62 cm/s). Normal antegrade vertebral flow. LEFT: Mildly atheromatous extracranial carotid arteries. Minor calcification at the carotid bifurcation. Normal antegrade vertebral flow. |
| 19/09/2024- Carotid duplex | RIGHT: Mild atheroma in the common and external carotid arteries. Small calcified plaque at the origin of the internal carotid artery causing <50% stenosis (PSV 49/13 cm/s). Normal antegrade vertebral flow. LEFT: Very mild calcification of the extracranial carotid arteries. Normal antegrade vertebral flow. |
| 20/09/2024- Carotid duplex | BILATERAL: Mild calcification of the extracranial carotid arteries. Not haemodynamically significant. Vertebral arteries not assessed |
| 20/09/2024- Carotid duplex | RIGHT: Mild atheroma in the common carotid artery. Stenosed external carotid artery. Calcified plaque at the origin of the internal carotid artery significant drop out. Velocities suggesting <50% stenosis (PSV 93 cm/s). Normal antegrade vertebral flow. LEFT: Mildly calcified common and external carotid artery. Significant drop out at the origin of the internal carotid artery. Velocities suggest 50-69% stenosis (PSV 133 cm/s) however the CCA/ICA ratio suggests <50%. Suggest alternative imaging if clinically indicated. Normal antegrade vertebral flow. |