

Peninsula Ultrasound Ltd

Carotid Duplex Scanning Protocol

APPLICABILITY: To all professionals performing carotid duplex scans.

PURPOSE: To evidence base best practice.

OBJECTIVE:

1. Carotid ultrasound examination is used to screen for carotid artery disease, which occurs mainly at the carotid bifurcation. Stroke is the most common cause of death in the UK. Up to 80% of ischemic strokes occur in the carotid territory of the brain supplied by the carotid arteries. Recent trials have shown that patients with significant carotid artery disease benefit from surgery.
2. To identify the flow direction and any atheroma in the CCA, ICA, ECA and vertebrals.
3. To determine the degree of narrowing/ stenosis using colour and pulse Doppler.

Carotid imaging is required to determine the presence and severity of carotid stenosis in those individuals who may be appropriate for carotid endarterectomy, i.e. those with a TIA or minor or recovered stroke involving the anterior circulation who are fit and willing for surgery. MRA should be reserved for cases where there is difficulty interpreting the Doppler scan or where either a carotid or vertebral artery dissection is suspected.

EQUIPMENT:

Duplex Doppler ultrasound machine with imaging frequencies of 5MHz and greater; with both linear and curvilinear transducers available. Doppler frequencies of at least 5.0MHz should be available, with colour Doppler capability.

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 five years after installation

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 couch.

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

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TECHNIQUE:

Examination performed with a 7MHz + linear array transducer (the higher the frequency the better resolution). If vessels are deep, use a lower frequency transducer. Set scanner to high velocities. Vessels best visualised through the sternocleidomastoid muscle which provides a good ultrasonic window using a lateral approach. The patient should ideally be lying down quite flat giving easy access to the neck.

1. In B mode the CCA, ICA and ECA should be visualised in a transverse section starting at the base of neck. On the right side it is possible to visualise the distal brachiocephalic artery and the origin of the CCA and subclavian arteries. The left CCA origin is rarely seen as it lies deep in the chest.
2. In B mode the CCA, ICA and ECA should be visualised in longitudinal section.
3. Observe any evidence of disease in B mode, measure intimal thickening and take images if required.
4. Use colour flow to investigate the flow from the proximal CCA up into the distal ICA and ECA. Identify the ECA branches, evidence of disease, velocity changes due to stenosis, area of filling defect due to presence of atheroma and absent flow due to occlusions.
5. Use spectral Doppler with colour flow and place sample volume along the CCA, ICA and ECA.
6. Measure peak systolic (PSV) and end diastolic velocities (EDV) in the CCA, ICA and ECA including distal segments. Measure PSV and EDV at site of the maximum velocity within any stenosis to allow the degree of narrowing to be graded. Take images of the segments and velocity measurements.
7. Draw and describe plaque type in the vessels with any significant velocity increase (as recommended by the Joint Working Group 2009 which enables an immediate visual indication of disease, severity and location).
8. Include any limitation of the scan in the report.
9. This procedure should be carried out bilaterally

GRADING THE STENOSIS:

Grading of stenosis is described in terms of diameter reduction. Velocity criteria are used to grade the degree of stenosis once the vessel has become narrowed by **>50%**. To calculate the degree of stenosis the following criteria is used as recommended by the Joint Working Group and UKAS guidelines :

1. PSV and EDV taken in the CCA and ICA and across the maximum point of any stenosis.
2. Calculate velocity ratios of either ICAPSV/CCAPSV and/or ICAPSV/CCAEDV.

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Professional Standards Committee – SVT Recommendations (Tim Hartshorn – SVT Magazine)

Percentage stenosis NASCET	ICA Peak systolic velocity cm/sec	ICA PSV/CCA PSV ratio	ICA PSV/CCA EDV ratio
<50	<125	<2	<8
50-59	>125	2-4	8-10
60-69			11-13
70-79	>230	>4	14-21
80-89			22-34
>90 but less than near occlusion	>400	>5	>35
Near Occlusion	High, low or string flow	Variable	Variable
Occlusion	No flow	Not applicable	Not applicable

PROBLEMS ENCOUNTERED:

1. Calcified atheroma at the bifurcation can lead to significant shadowing on the image which can cause problems with the grading.
2. Large plaques in a wide carotid bulb. PSV may be below 70% NASCET. Diameter of residual volume should be compared with the total diameter of the bulb.
3. Vessel tortuosity can be a problem as vessels may not appear in a single plane but colour Doppler will help in identifying the vessels.
4. Older patients have loss of cerebrovascular compliance with associated stiffening of arterial walls which can result in abnormal high velocities bilateral with very low diastole velocities. Use velocity ratios.
5. Abnormal waveforms with absent or decreased CCA end diastole bilaterally. This indicates presence of inflow disease or aortic valve regurgitation and makes velocities and ratio calculations unreliable.
6. PSV across an ICA stenosis may be elevated in the presence of a significant contra-lateral stenosis/occlusion. Velocity ratios are more reliable.
7. Non-atheromatous extra cranial carotid vessels included aneurysm, carotid body tumours and dissection.

Symptomatic patients with >50% stenosis should be referred to the Vascular Surgeon on call immediately. Please phone vascular secretaries or bleep surgeon on call. Inform stroke physician. Document if patient has been referred.

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REFERENCES:

1. Physiological measurement service specifications SVT
2. Joint recommendations for reporting ultrasound investigations in the UK 2009 (Oates et al Euro J Vasc Endovasc Surg))
3. Professional Standards Committee Update UKAS 2010
4. Vascular Lab practices books 2006
5. ECST Collaborative Group 1998
6. NASCET Collaborators 1991
7. Thrush A, Hartshorne T, Ultrasound assessment of the extra cranial cerebral circulation

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1. Policy Approval

The Peninsula Ultrasound acknowledges that information is a valuable asset, therefore it is wholly in its interest to ensure that the information it holds, in whatever form, is appropriately governed, protecting the interests of all of its stakeholders.

This policy, and its supporting standards and work instruction, are fully endorsed by the Board through the production of these documents and their minuted approval.

I trust that all staff, contractors and other relevant parties will, therefore, ensure that these are observed in order that we may contribute to the achievement of the company’s objectives and the delivery of effective healthcare to the local population.

Chief Executive: _____

Date _____

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