

Reason	Stroke			
Outcome	Stenosis moderate, Obscured, Calcified, Poor images			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.07	0.15	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.99	0.27	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
		Pk ICA/Pk CCA = 0.9	Pk ICA/End CCA = 6.6	
External		2.57		< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.70	0.15	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.98	0.48	60% - 69%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
		Pk ICA/Pk CCA = 2.8	Pk ICA/End CCA = 13.2	
External		1.84		< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right ICA forming a less than 40% stenosis.

LEFT

The left proximal ICA was obscured for ~0.84cm due to acoustic shadowing. Velocities obtained distal to obscured region suggest moderate 60-69% stenosis, however unable to accurately grade or rule out greater stenosis. Total disease length ~1.2cm distal to bifurcation. Distal ICA is patent.

Suggest vascular surgical opinion, if appropriate.

Assessed by David Barrett

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Suggest alternate imaging.

Assessed by David Barrett

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Reason	Stroke			
Outcome	Stenosis moderate, Obscured, Calcified, Poor images			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.89	0.14	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.84	0.27	< 30%
Plaque	Intimal Thickening			
Disease length from BIF		Pk ICA/Pk CCA = 0.9	Pk ICA/End CCA = 6.0	
External		1.22		< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Vertebral	Not Identified			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.97	0.15	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				40% - 49%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.70	0.44	50% - 59%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 1.8	Pk ICA/End CCA = 11.3	
External		1.32		< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Not Identified			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Intimal thickening identified in the right ICA forming a less than 30% reduction in luminal diameter.

LEFT

The origin of the left ICA was obscured for ~1.1cm due to acoustic shadowing. Velocities obtained distal are suggestive of a moderate 50-59% stenosis, however unable to accurately grade or rule out greater stenosis in obscured region. Where seen, mixed, dense and calcified plaque identified forming a less than 50% stenosis.

Suggest vascular surgical opinion, if appropriate.
Suggest alternate imaging.



Reason TIA clinic
Outcome Stenosis moderate, Calcified

Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.19	0.24	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					50% - 59%
Plaque	Dense Mixed Calcified				
Disease length from BIF					
Internal			1.66	0.29	50% - 59%
Plaque	Dense Mixed Calcified				
Disease length from BIF			Pk ICA/Pk CCA = 1.4	Pk ICA/End CCA = 6.9	
External			2.70		< 40%
Plaque	Dense Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence		Good Signal	Triphasic	Widely Patent

Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.28	0.24	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Dense Mixed Calcified				
Disease length from BIF					
Internal			1.04	0.21	< 40%
Plaque	Dense Mixed Calcified				
Disease length from BIF			Pk ICA/Pk CCA = 0.8	Pk ICA/End CCA = 4.3	
External			1.80		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence		Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right carotid bifurcation forming a 50-59% stenosis based on greyscale and colour flow imaging. Disease extends into the right ICA forming a 50-59% stenosis at the origin. Total disease length ~1cm including bifurcation. Distal ICA is patent.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a less than 40% stenosis.

Suggest vascular surgical opinion, if appropriate.

Assessed by David Barrett

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Reason	Stroke				
Outcome	Stenosis mild, Stenosis moderate, Calcified				
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.50	0.12	< 40%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					50% - 59%
Plaque	Dense Mixed				
Disease length from BIF					
Internal			1.78	0.29	40% - 49%
Plaque	Mixed				
Disease length from BIF		Pk ICA/Pk CCA = 3.6		Pk ICA/End CCA = 14.8	
External			3.53		50% - 59%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.68	0.17	< 40%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Dense Mixed				
Disease length from BIF					
Internal			0.70	0.20	< 50%
Plaque	Dense Mixed Calcified				
Disease length from BIF		Pk ICA/Pk CCA = 1.0		Pk ICA/End CCA = 4.1	
External			1.54		< 30%
Plaque	Intimal Thickening				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent

Stenosis based on NASCET methods.
Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

RIGHT

Mixed and dense plaque identified in the right carotid bifurcation forming a 50-59% stenosis based on greyscale, colour flow imaging, and direct luminal diameter reduction measurements. Disease extends in the right proximal ICA forming a 40-49% stenosis. Distal ICA is patent.
Mixed plaque identified at the origin of the right ECA forming a 50-59% stenosis.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a less than 50% stenosis.

Assessed by David Barrett

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Suggest vascular surgical opinion, if appropriate.

Reason	TIA clinic				
Outcome	Stenosis moderate, Intimal hyperplasia				
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.42	0.11	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					40% - 49%
Plaque	Mixed Soft				
Disease length from BIF					
Internal			0.63	0.22	50% - 59%
Plaque	Mixed Soft				
Disease length from BIF		Pk ICA/Pk CCA = 1.5		Pk ICA/End CCA = 5.7	
External			0.73		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.57	0.17	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Intimal Hyperplasia				
Disease length from BIF					
Internal			0.45	0.14	< 40%
Plaque	Intimal Hyperplasia				
Disease length from BIF		Pk ICA/Pk CCA = 0.8		Pk ICA/End CCA = 2.6	
External			0.94		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT**

*Prev L CEA.

RIGHT

Mixed and echolucent ?soft plaque identified in the right ICA forming a 50-59% stenosis based on greyscale, colour flow imaging and direct luminal diameter reduction measurements. However, no raised velocities noted ?due to soft smooth plaque. Total disease length ~1.4cm including bifurcation. Distal ICA is patent.

LEFT

Intimal hyperplasia identified in the left ICA forming a less than 40% stenosis.

Assessed by David Barrett

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Suggest vascular surgical opinion, if appropriate.



Reason	Routine
Outcome	Stenosis severe, Calcified

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.17	0.25	< 30%
Plaque	Mixed			
Disease length from BIF				
Bifurcation				< 30%
Plaque	Dense Mixed			
Disease length from BIF				
Internal		1.00	0.25	< 30%
Plaque	Mixed			
Disease length from BIF		Pk ICA/Pk CCA = 0.9	Pk ICA/End CCA = 4.0	
External		1.91		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.00	0.11	< 40%
Plaque	Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.19		96% - 99%
Plaque	Dense Mixed Soft Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.2	Pk ICA/End CCA = 1.7	
External		1.27		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed plaque identified in the right ICA forming a less than 30% stenosis.

LEFT

Mixed, dense, calcified and echolucent ?soft plaque identified in the left ICA forming a 96-99% stenosis along its length with low flow PSV 19cm/s ?trickle flow identified. Trickle flow extends into the distal ICA.



Reason	Stroke
Outcome	Stenosis severe, Occlusion, Obscured, Calcified, Poor images, Subclavian Steal

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.67		< 50%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				50% - 59%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal				= 100%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
		Pk ICA/Pk CCA = 0.0		
External		1.09		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Oscillatory			
Subclavian	Moderate Turbulence	Good Signal	Triphasic	Mild/Moderate Stenosis

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.09		< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 0%
Plaque	Dense Mixed Calcified			
Disease length from BIF	but is obscured			
Internal		0.41 *		< 0%
Plaque	Dense Mixed Calcified			
Disease length from BIF	but is obscured			
		Pk ICA/Pk CCA = 4.6		
External		0.32		< 0%
Plaque	Mixed			
Disease length from BIF	but is obscured			
Vertebral	Open Orthograde			
Subclavian	Severe Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods. If marked * ALWAYS read full notes.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

*Previous known right ICA occlusion on CT and duplex ultrasound (June 2021)

*Previous ~70-79% stenosis of left ICA on CT and duplex ultrasound (June 2021).

RIGHT

The right internal carotid artery appears chronically occluded with no colour, spectral or power Doppler signal obtained within the vessel lumen.

Turbulent waveforms noted proximal right subclavian artery, with oscillatory vertebral artery flow noted, indicative of right partial subclavian steal syndrome.

Assessed by David Barrett

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Mixed, dense and calcified plaque identified in the right carotid bifurcation forming a 50-59% stenosis based on greyscale and colour flow imaging.

LEFT

*Very challenging assessment of left carotid system due to heavy calcification and acoustic shadowing. Very low/absent damped flow noted in proximal and distal common carotid artery (PSV 9cm/s), ?due to severe proximal stenosis ?increase in proximal stenosis severity since previous assessment (June 2021) due to decrease/absence of flow observed in CCA. Severely turbulent flow noted in left proximal subclavian artery (PSV 404cm/s) and vertebral artery (PSV 263cm/s) ?severe proximal stenosis.

The left carotid bifurcation, ICA and ECA origins were obscured for ~1.02cm due to acoustic shadowing - unable to accurately grade.

Where seen, flow in the mid ICA appears damped and slightly oscillatory PSV 41cm/s, ?oscillatory due to severe proximal stenosis.

Retrograde and low resistant flow noted in ECA ?high grade proximal stenosis/occlusion of proximal ECA.

SUGGEST ALTERNATE IMAGING.

SUGGEST VASCULAR SURGICAL OPINION.



Reason	Stroke			
Outcome	Stenosis mild, Calcified, disease - mild			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.86		< 40%
Plaque	Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.00	0.19	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 1.2		
External		1.07		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.71	0.10	< 30%
Plaque	Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.08	0.17	40% - 49%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 1.5		Pk ICA/End CCA = 10.8
External		1.32		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right ICA forming a less than 50% stenosis.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a 40-49% stenosis.



Reason	Routine
Outcome	Stenosis moderate, Obscured, Calcified

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.66	0.10	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.43	0.43	50% - 59%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 2.2	Pk ICA/End CCA = 14.3	
External		3.12		50% - 59%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.93	0.18	< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.66	0.19	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.7	Pk ICA/End CCA = 3.7	
External		1.04		< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

RIGHT

The right proximal ICA was obscured for ~1.3cm due to acoustic shadowing. Velocities distal to obscured region are suggestive of a moderate 50-59% stenosis, however unable to rule out greater stenosis in obscured region. Disease length ~2cm including bifurcation. Distal ICA is patent. Where seen, mixed, dense and calcified plaque identified in the right ICA forming a less than 50% stenosis.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a less than 50% stenosis.

Assessed by David Barrett

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Reason	Routine			
Outcome	Stenosis mild, Calcified			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.62	0.07	< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Bifurcation				40% - 49%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.03	0.23	40% - 49%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
		Pk ICA/Pk CCA = 1.7	Pk ICA/End CCA = 14.7	
External		1.59		< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.97	0.09	< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.77	0.21	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
		Pk ICA/Pk CCA = 0.8	Pk ICA/End CCA = 8.6	
External		1.27		< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right carotid bifurcation and ICA forming a 40-49% stenosis.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a less than 50% stenosis.

Assessed by David Barrett

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Reason	TIA clinic
Outcome	Stenosis moderate, Calcified

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.91	0.15	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				50% - 59%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.40	0.38	50% - 59%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
	Pk ICA/Pk CCA = 1.5		Pk ICA/End CCA = 9.3	
External		1.83		< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.78	0.15	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Internal		1.04	0.26	< 30%
Plaque	Mixed			
Disease length from BIF				
	Pk ICA/Pk CCA = 1.3		Pk ICA/End CCA = 6.9	
External		1.73		< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

RIGHT

Mixed, dense and calcified plaque identified in the right carotid bifurcation forming a 50-59% stenosis. Disease extends into proximal ICA forming a 50-59% stenosis at the origin of the ICA, based on greyscale, colour flow imaging, velocities obtained, and direct luminal diameter reduction measurements. Disease length ~1.94cm including bifurcation. Distal ICA is patent.

LEFT

Mixed and dense plaque identified in the left ICA forming a less than 30% stenosis.

Assessed by David Barrett

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Suggest vascular surgical opinion, if appropriate.

Reason	TIA clinic
Outcome	Stenosis mild, Stenosis severe, Calcified

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.21	0.26	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				40% - 49%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.96	0.33	40% - 49%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.8	Pk ICA/End CCA = 3.7	
External		2.06		< 40%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.12	0.25	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.90	0.40	< 40%
Plaque	Dense Mixed			
Disease length from BIF		Pk ICA/Pk CCA = 0.8	Pk ICA/End CCA = 3.6	
External		4.61		70% - 79%
Plaque	Mixed Soft			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

RIGHT

Mixed, dense and calcified plaque identified in the carotid bifurcation and proximal ICA forming a 40-49% stenosis.

LEFT

Mixed and dense plaque identified in the left ICA forming a less than 40% stenosis.

Additional comments: Mixed and echolucent ?soft plaque identified in the left external carotid artery forming a 70-79% stenosis.

Assessed by David Barrett

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Reason	Pre-op CABG			
Outcome	Stenosis moderate, Obscured, Calcified, Poor images			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.83	0.18	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.08	0.47	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 1.3	Pk ICA/End CCA = 6.0	
External		1.38		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.92	0.25	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		2.62 *	0.88	< 0%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 2.8	Pk ICA/End CCA = 10.5	
External		1.68		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods. If marked * ALWAYS read full notes.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

*Challenging assessment due to heavily calcified arteries bilaterally - some poor images obtained.

RIGHT

Mixed, dense and calcified plaque identified in the right ICA forming a less than 50% stenosis.

LEFT

The left distal ICA is obscured for ~0.4cm due to acoustic shadowing. Velocities obtained in the distal ICA (~2.2cm distal to bifurcation) are suggestive of a moderate stenosis (60-69%) however very poor views obtained - unable to accurately grade distal region. Mixed, dense and calcified plaque identified in the proximal ICA forming a less than 50% stenosis.

Assessed by David Barrett

Printed on 06/08/2022 at 2:40 pm

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Suggest alternate imaging to confirm left distal ICA stenosis.
Suggest vascular surgical opinion, if appropriate.



Reason	Stroke
Outcome	Stenosis severe, Occlusion, Calcified

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.63	0.12	< 30%
Plaque	Mixed			
Disease length from BIF				
Bifurcation				< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal				= 100%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.0	Pk ICA/End CCA = 0.0	
External		1.78		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.85	0.21	< 40%
Plaque	Dense Mixed			
Disease length from BIF				
Bifurcation				< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		5.65	3.32	90% - 95%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 6.6	Pk ICA/End CCA = 26.9	
External		1.17		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

The right internal carotid artery appears occluded with mixed, dense and calcified plaque - no colour, spectral or power Doppler signal obtained within the vessel lumen.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a 90-95% stenosis based on greyscale, colour flow imaging, and velocities obtained. Disease length ~1.7cm including bifurcation. Distal ICA is patent.

SUGGEST URGENT VASCULAR SURGICAL OPINION.

Reason	TIA clinic			
Outcome	Stenosis moderate, Calcified			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.09	0.14	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.84	0.42	60% - 69%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 1.7	Pk ICA/End CCA = 13.1	
External		1.53		< 25%
Plaque	Normal			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.04	0.12	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.20	0.17	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 1.2	Pk ICA/End CCA = 10.0	
External		1.53		< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right ICA forming a 60-69% stenosis based on greyscale, colour flow imaging, velocities obtained, and direct luminal diameter reduction measurements. Disease length ~1.5cm including bifurcation. Distal ICA is patent.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a less than 50% stenosis.

Suggest vascular surgical opinion, if appropriate.

Assessed by David Barrett

Printed on 06/08/2022 at 2:33 pm

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Reason	Stroke				
Outcome	Calcified, disease - mild				
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.51	0.12	< 30%
Plaque	Intimal Thickening				
Disease length from BIF					
Bifurcation					< 30%
Plaque	Dense Mixed				
Disease length from BIF					
Internal			0.73	0.26	< 40%
Plaque	Dense Mixed Calcified				
Disease length from BIF		Pk ICA/Pk CCA = 1.4		Pk ICA/End CCA = 6.1	
External			0.65		< 30%
Plaque	Intimal Thickening				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.50	0.13	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 30%
Plaque	Mixed				
Disease length from BIF					
Internal			0.77	0.28	< 30%
Plaque	Mixed				
Disease length from BIF		Pk ICA/Pk CCA = 1.5		Pk ICA/End CCA = 5.9	
External			0.35		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right ICA forming a less than 40% stenosis.

LEFT

Mixed plaque identified in the left ICA forming a less than 30% stenosis.



Reason	TIA clinic				
Outcome	Widely patent				
<hr/>					
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.37	0.29	< 25%
Plaque	Normal				
Disease length from BIF					
Bifurcation					< 25%
Plaque	Normal				
Disease length from BIF					
Internal			1.33	0.32	< 25%
Plaque	Normal				
Disease length from BIF		Pk ICA/Pk CCA = 1.0		Pk ICA/End CCA = 4.6	
External			1.81		< 25%
Plaque	Normal				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent	
<hr/>					
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.44	0.22	< 25%
Plaque	Normal				
Disease length from BIF					
Bifurcation					< 25%
Plaque	Normal				
Disease length from BIF					
Internal			1.11	0.29	< 25%
Plaque	Normal				
Disease length from BIF		Pk ICA/Pk CCA = 0.8		Pk ICA/End CCA = 5.0	
External			1.58		< 25%
Plaque	Normal				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent	

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

The right and left extra-cranial carotid arteries appear widely patent. No evidence of any plaque morphology, intimal dissection or other abnormality identified.



Reason	Routine				
Outcome	Widely patent				
<hr/>					
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.50	0.38	< 25%
Plaque	Normal				
Disease length from BIF					
Bifurcation					< 25%
Plaque	Normal				
Disease length from BIF					
Internal			1.15	0.34	< 25%
Plaque	Normal				
Disease length from BIF		Pk ICA/Pk CCA = 0.8		Pk ICA/End CCA = 3.0	
External			0.94		< 25%
Plaque	Normal				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent
<hr/>					
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.53	0.35	< 25%
Plaque	Normal				
Disease length from BIF					
Bifurcation					< 25%
Plaque	Normal				
Disease length from BIF					
Internal			1.22	0.38	< 25%
Plaque	Normal				
Disease length from BIF		Pk ICA/Pk CCA = 0.8		Pk ICA/End CCA = 3.5	
External			1.13		< 25%
Plaque	Normal				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

The right and left extra-cranial carotid arteries appear widely patent. No evidence of any plaque morphology, intimal dissection or other abnormality identified.



Reason	TIA clinic
Outcome	Calcified, disease - mild

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.87	0.16	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Internal		0.83	0.19	< 30%
Plaque	Intimal Thickening			
Disease length from BIF		Pk ICA/Pk CCA = 1.0	Pk ICA/End CCA = 5.2	
External		2.03		< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Not Identified	Triphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.04	0.23	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 30%
Plaque	Dense Mixed			
Disease length from BIF				
Internal		0.97	0.33	< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.9	Pk ICA/End CCA = 4.2	
External		1.56		< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Intimal thickening identified in the right ICA forming a less than 30% reduction in luminal diameter.

LEFT

Mixed, dense and calcified plaque identified in the left ICA forming a less than 50% stenosis.

Assessed by David Barrett

Printed on 06/08/2022 at 3:06 pm

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Reason	TIA clinic				
Outcome	disease - mild				
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.06	0.28	< 40%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Dense Mixed				
Disease length from BIF					
Internal			0.94	0.30	< 40%
Plaque	Mixed				
Disease length from BIF		Pk ICA/Pk CCA = 0.9		Pk ICA/End CCA = 3.4	
External			0.99		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.83	0.21	< 40%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Mixed				
Disease length from BIF					
Internal			0.93	0.35	< 30%
Plaque	Dense Mixed				
Disease length from BIF		Pk ICA/Pk CCA = 1.1		Pk ICA/End CCA = 4.4	
External			1.04		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed plaque identified in the right ICA forming a less than 40% stenosis.

LEFT

Mixed and dense plaque identified in the left ICA forming a less than 30% stenosis.

Assessed by David Barrett

Printed on 06/08/2022 at 2:52 pm

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Reason	Stroke				
Outcome	Widely patent				
<hr/>					
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.11	0.13	< 25%
Plaque	Normal				
Disease length from BIF					
Bifurcation					< 25%
Plaque	Normal				
Disease length from BIF					
Internal			0.80	0.21	< 25%
Plaque	Normal				
Disease length from BIF		Pk ICA/Pk CCA = 0.7		Pk ICA/End CCA = 6.2	
External			0.67		< 25%
Plaque	Normal				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent	
<hr/>					
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.49	0.23	< 25%
Plaque	Normal				
Disease length from BIF					
Bifurcation					< 25%
Plaque	Normal				
Disease length from BIF					
Internal			0.93	0.25	< 25%
Plaque	Normal				
Disease length from BIF		Pk ICA/Pk CCA = 0.6		Pk ICA/End CCA = 4.0	
External			0.65		< 25%
Plaque	Normal				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent	

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT**

The right and left extra-cranial carotid arteries appear widely patent. No evidence of any plaque morphology, intimal dissection or other abnormality identified.



Reason	TIA clinic			
Outcome	Calcified, disease - mild			
Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.42	0.33	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		0.93	0.22	< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.7	Pk ICA/End CCA = 2.8	
External		1.50		< 30%
Plaque	Mixed			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent
Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.39	0.28	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 50%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Internal		1.01	0.23	< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF		Pk ICA/Pk CCA = 0.7	Pk ICA/End CCA = 3.6	
External		1.59		< 40%
Plaque	Dense Mixed Calcified			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Triphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT**

Mixed, dense and calcified plaque identified in the right and left ICA forming a less than 40% stenosis bilaterally.



Reason Stroke
Outcome Well vascularised mass, Calcified, disease - mild

Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.79	0.15	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 50%
Plaque	Dense Mixed Calcified				
Disease length from BIF					
Internal			1.01	0.28	< 40%
Plaque	Dense Mixed Calcified				
Disease length from BIF			Pk ICA/Pk CCA = 1.3	Pk ICA/End CCA = 6.7	
External			0.66		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Triphasic		Widely Patent

Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			0.88	0.16	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Dense Mixed Calcified				
Disease length from BIF					
Internal			0.81	0.21	< 30%
Plaque	Mixed				
Disease length from BIF			Pk ICA/Pk CCA = 0.9	Pk ICA/End CCA = 5.1	
External			0.81		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes**CAROTID DUPLEX ASSESSMENT****RIGHT**

Mixed, dense and calcified plaque identified in the right ICA forming a less than 40% stenosis.

LEFT

Mixed plaque identified in the left ICA forming a less than 30% stenosis.

Additional comments: Enlarged vascularised mass noted in the right and left thyroid regions measuring ~1.6cm x 2.6cm and ~1.8cm x 1.9cm, respectively - suggest general ultrasound, if appropriate.

Assessed by David Barrett

Printed on 06/08/2022 at 2:35 pm

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Reason TIA clinic
Outcome Cyst, disease - mild

Right	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		0.96	0.17	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Internal		0.60	0.17	< 30%
Plaque	Intimal Thickening			
Disease length from BIF		Pk ICA/Pk CCA = 0.6	Pk ICA/End CCA = 3.5	
External		0.82		< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Left	Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common		1.03	0.20	< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Bifurcation				< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Internal		0.84	0.20	< 40%
Plaque	Dense Mixed			
Disease length from BIF		Pk ICA/Pk CCA = 0.8	Pk ICA/End CCA = 4.2	
External		0.91		< 30%
Plaque	Intimal Thickening			
Disease length from BIF				
Vertebral	Open Orthograde			
Subclavian	No Turbulence	Good Signal	Biphasic	Widely Patent

Stenosis based on NASCET methods.

Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

RIGHT

Intimal thickening identified in the right ICA forming a less than 30% reduction in luminal diameter.

LEFT

Mixed and dense plaque identified in the left ICA forming a less than 40% stenosis.

Additional comments: Non-vascularised echolucent/mixed echogenic ?cyst noted anterior to carotid bifurcation on right (~1.9cm x 3cm) and left (~1.1cm x 1.5cm) side - suggest general ultrasound, if appropriate.

Assessed by David Barrett

Printed on 06/08/2022 at 2:32 pm

Checked by



Reason	Stroke				
Outcome	disease - mild				
<hr/>					
Right		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.07	0.29	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Dense Mixed				
Disease length from BIF					
Internal			1.13	0.32	< 30%
Plaque	Mixed				
Disease length from BIF		Pk ICA/Pk CCA = 1.1		Pk ICA/End CCA = 3.9	
External			1.27		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent
<hr/>					
Left		Diameter (cm)	PSV (m/s)	EDV (m/s)	Stenosis
Common			1.32	0.31	< 30%
Plaque	Mixed				
Disease length from BIF					
Bifurcation					< 40%
Plaque	Dense Mixed				
Disease length from BIF					
Internal			0.94	0.32	< 40%
Plaque	Dense Mixed				
Disease length from BIF		Pk ICA/Pk CCA = 0.7		Pk ICA/End CCA = 3.0	
External			1.05		< 30%
Plaque	Mixed				
Disease length from BIF					
Vertebral	Open Orthograde				
Subclavian	No Turbulence	Good Signal	Biphasic		Widely Patent

Stenosis based on NASCET methods.
Disease within large diameter carotid bulb is measured using direct diameter methods as recommended in Oates et al (2009).

Notes

CAROTID DUPLEX ASSESSMENT

RIGHT

Mixed plaque identified in the right ICA forming a less than 30% stenosis.

LEFT

Mixed and dense plaque identified in the left ICA forming a less than 40% stenosis.



CL1.3

3. Extra-cranial carotid/ brachio-cephalic/ subclavian/ vertebral assessment

Probe types – 12 - 3MHz

Measurements – Velocities in centimetres per second (cm/s), diameter (transverse; anterior-posterior, medial-lateral) in centimetres (cm) (if dilated/pre-op), length of disease (longitudinal) in cm.

Patient positioning and scanning approach – patients can be scanned supine or in a sitting position. A supine approach with the vascular scientist sat behind the patient's head allows easy access to the neck and reduces the risk of RSI (repetitive strain injury) as the operator can rest their arm on the pillow or on the head of couch. The patient extends the neck and turns the head in the opposite direction to the side being assessed. Both sides of the neck are always assessed¹.

The carotid arteries can be viewed from a lateral or antero-lateral approach using the sternocleidomastoid muscle as an acoustic window².

B-mode assessment

Intimal B-mode assessment is performed to achieve an accurate picture of the anatomy and identify the location of the carotid bifurcation as well as the presence of any plaque morphology^{2,3}.

Using B-mode, the common carotid artery (CCA) should be imaged in cross-section (transverse plane) and traced proximally to the clavicle until the subclavian artery is visualised. The distal brachio-cephalic artery may be visualised on the right side of the neck. On the left side, the origin of the CCA and subclavian arteries will not be visualised due to depth. The CCA should then be scanned along its length to the level of the bifurcation where the internal carotid artery (ICA) and external carotid artery (ECA) are visualised from their origins as far distal as possible.

The same method should then be repeated in longitudinal plane².

Colourflow assessment

Using the Colourflow modality, the CCA is scanned longitudinally where it is traced from the proximal section at the level of the clavicle to the distal section where the bifurcation, ICA and ECA are visualised as far distal as possible.

Colour should be used to identify ECA branches, filling defects, occlusion and velocity changes/ turbulence, although diagnosis should not be made using colour Doppler alone^{2,3}.

Grading plaque morphology – greyscale echogenicity

Switching to the greyscale imaging mode, a note can be made of the site, type and extent of plaque morphology.

The subclavian is visualised along its length in longitudinal section. The CCA, ICA and ECA are then viewed in cross-section and longitudinally. As soft plaque has the same echogenicity as blood, colourflow is the best modality for identification.



Soft plaque – associated with higher lipid content or thrombus. May have an anechoic or echolucent appearance similar to that of blood/fluid^{2,3}

Mixed plaque – variable/ heterogenous appearance of mixed or random echoes with some echogenic and some echolucent areas^{2,3}.

Dense plaque – homogenous appearance of bright white echoes⁴.

Calcified plaque – acoustic shadowing cast from the hardened plaque^{2,3}.

Irregular – broken or irregular luminal surface but not generally an indication of ulceration¹⁶.

Ulcerative – an area of mixed plaque forming a ‘crater’ of at least 2mm depth. May be seen in cross-section as a ‘hook’ of mixed plaque surrounding soft plaque, or with blood visibly swirling within the crater^{2,3}.

Doppler assessment

In the absence of significant disease, peak systolic velocity (PSV) measurements are taken from the CCA (1-2cm proximal to bifurcation) ^{1, 2}, ICA and ECA. If the peak velocities are raised above 1.3m/s then the end-diastolic velocity (EDV) is also measured.

If significant plaques have been identified using B-mode and colour flow Doppler then further spectral Doppler samples are taken to investigate velocity increases and analyse the degree of stenosis in particular vessel. Stenosis in the ICA is graded using the criteria explained below. Atypical waveform profiles should also be noted^{2, 3}.

In cross-section, the CCA is traced proximal towards the clavicle and the transducer is angled beneath the clavicle until the subclavian artery is viewed in longitudinal section. The subclavian is traced as far proximal and distal as possible making note of areas of turbulence or narrowing. The PSV is measured using Doppler ultrasound. A second Doppler reading is taken as far distal as possible and the waveform characteristics are recorded (e.g. triphasic, biphasic, monophasic, turbulent, damped etc.).

Velocities in kinked arteries are less reliable as vessel tortuosity can raise velocities¹⁷. Care must be taken to ensure that the angle is correct to blood flow rather than the vessel³. In reporting, it will be stated ‘peak velocities indicate x% - y% stenosis but no plaque morphology noted.

Grading degree of carotid stenosis

Normal Velocities:

ICA:

- average (avg) PSV = 54 – 88cm/s (distal to bulb)⁴
- avg PSV = 74cm/s, avg EDV = 29cm/s (distal to bulb)⁵
- velocity slightly elevated if patient hypertensive⁶
- maximum PSV noted in normal = 115cm/s⁷



ECA:

- avg PSV \approx 77cm/s (normally <115cm/s)⁴
- avg PSV = 84cm/s, avg EDV = 16cm/s⁵
- ECA velocities can be elevated by an ipsilateral ICA occlusion⁴

CCA:

- avg PSV = 60 – 100cm/s⁸
- avg PSV = 108 +/- 18 cm/s (mean +/-S.D.)⁹
- avg PSV = 78-108 cm/s⁷
- avg PSV = 99cm/s, avg EDV = 27cm/s⁵
- on average, PSV in L CCA exceeds PSV in R CCA by 5cm/s⁹
- velocity slightly elevated if patient hypertensive⁶

Carotid Criteria

Diameter Stenosis	Morphology	ICA PSV (cm/s)	ICA EDV (cm/s)	PSVica/PSVcca	St Mary's ratio
<25%	Normal	<130	<40		
<30%	Intimal Thickening	<130	<40		
<30%	Plaque	<130	<40		
<40%	Plaque	<130	<40		
<50%	Plaque	<130	<40	<2	<8
50-59%	Plaque	>130	<40	<3.2	8.0-10
60-69%	Plaque	>130	40-110	3.2-4.0	11-13
70-79%	Plaque	>230	110-140	>4.0	14-21
80-89%	Plaque	>230	>140	>4.0	22-29
90-95%	Plaque	>400	>140	>5.0	>30
96-99%	Plaque	Trickle flow			Variable
100%	Plaque	Absence of flow			N/A

Sidhu and Allan. Ultrasound Assessment of Internal Carotid Artery Stenosis. Clinical Radiology, (1997) 52, 654-658. (Developed using data from Moneta et al. 1993, 1995). CP Oates et al. Joint recommendations for Reporting Carotid Ultrasound Investigations in the UK. EurJ Vasc Endovasc Surg (2008) 20, 1-11.

Criteria are only reliable for internal carotid artery stenosis³.

ICA peak systolic velocities are less reliable in the presence of CCA disease and ratios should be used. The use of the ICA: CCA PSV ratio normalises ICA PSV measurements^{2 3}.

Elevated velocities can be produced in the CCA, ICA¹⁹ and ECA in the presence of contralateral CCA or ICA stenosis or occlusion.

A significant proximal (CCA origin or brachio-cephalic) ipsilateral stenosis can reduce velocities in the CCA, ICA and ECA.



Aortic stenosis can reduce the velocities in the CCA only.

Peak systolic velocities from large carotid bulbs may be unreliable, estimate degree of stenosis using grey scale and diameter/area reduction measurement.

Doppler Waveforms:

1. CCA waveform has a low-resistance pattern (most of the CCA flow goes to the brain). Note that a small amount of post systolic flow reversal (giving rise to a triphasic waveform) is normal; reversal of flow evident for more than 50% of the duration of diastole should be regarded as abnormal (see point 5 below)¹⁰.
2. Normal ICA waveform has low-resistance pattern (all of the ICA flow goes to brain)¹⁸.
3. Normal ECA waveform has a high-resistance pattern (vessel supplies a high resistance vascular bed). Note the prominent dicrotic notch, which represents closure of the aortic valve and the onset of diastole¹⁰.
4. Severe proximal stenosis (innominate artery, CCA origin, aortic valve) produces a damped waveform ("tardus-parvus", where tardus infers the pulse is slow to rise and fall and parvus infers a small pulse.)^{4, 8}. Essentially, the acceleration time to systole is increased, hence the slope of the systolic upstroke is reduced, and there is blunting and smoothing of the sharp peak representing a reduction in waveform pulsatility⁹. This effect is usually most prominent in the CCA, but is also sometimes seen in the ICA & ECA. Note that in the case of aortic valve disease or diminished cardiac output, damping is symmetrical (seen in both CCAs)⁴.
5. Severe aortic incompetence with or without the presence of significant aortic stenosis often produces either a bisferious (two systolic peaks, well separated from the dicrotic notch, with the second peak being the same height as or higher than the first) waveform¹⁰, or persistent reverse diastolic flow in the CCA, or both. Note that these effects are not usually seen in the ICA, but are evident in both the CCA & ECA.
6. Significant stenosis or occlusion of the distal CCA or the ICA causes a high-resistance ipsilateral CCA waveform; reverse flow is evident and often there is complete loss of end diastolic flow. Note that significant ECA disease does not usually impact on the CCA waveform due to its relatively low flow volume⁴.

External Carotid Artery Assessment

From searching the literature (pubmed, medline, science direct, quest) there is no evidence of a radiologically validated method for grading ECA disease using a velocity criteria.

There is normally little requirement for the grading of ECA disease due to its highly branched vascular network and non-cerebral involvement^{13,15}. In cases where a patient experiences cerebral or ocular symptoms in the presence of ipsilateral ICA occlusion it may be useful to grade and characterise ECA disease as a possible cause of emboli and transient ischaemic attack (TIA). There is much published evidence extolling the



benefit of surgical or radiological intervention for the treatment of ECA disease where there is ipsilateral ICA occlusion and a thorough examination of disease is important in these cases^{13,14,15}.

At present staff use a visual estimation and/or use of electronic callipers to measure degree and extent of stenotic disease.

In the presence of an ICA occlusion, electronic callipers should be used in the transverse and longitudinal planes to measure degree of ECA stenosis. Length of stenosis, plaque characterisation and degree of turbulence should also be recorded in the report.

Vertebral artery assessment

The vertebral artery (VA) can be viewed if the transducer is angled posterior. The flow direction should be the same as the carotid flow direction and is checked using the colourflow, **but more** importantly the Doppler sample volume. Vertebral flow is graded as orthograde, oscillatory (i.e. reversed in either systole or diastole alone) or retrograde^{2,3}. If no colourflow is identified within the vessel lumen – use spectral or power Doppler to investigate as it is more sensitive than colourflow⁴.

NORMAL VELOCITIES:

- avg PSV = 20-40 cm/s^{2,3}
- PSV < 10 cm/s should be regarded as potentially abnormal⁴
- Higher velocities may be normal in the dominant VA of an asymmetric pair.^{2,3}
- Higher velocities may be normal with contralateral VA occlusion.^{2,3}
-

DOPPLER WAVEFORMS:

1. Normal VA waveform has a low-resistance pattern (supplying the brain), with cephalad flow throughout the cycle^{2,4}.
2. If the VA has a high-resistance, antegrade (cephalic) flow pattern, there is probably a significant obstruction distal to the site of examination. (The second most common site of VA atheroma is intracranially, just beyond the C1 arch)³.
3. Severe proximal stenosis produces a damped waveform; note that the most common site of VA atheroma is the VA origin, although this can be difficult to image as it originates from the posterior aspect of the subclavian artery³.
4. Subclavian artery origin stenosis can have varying effects on the VA waveform shape and the direction of flow, dependent on the degree of stenosis and the presence of other collateral pathways.

DUPLEX CAROTID GRADING CRITERIA:

Diameter Stenosis	Morphology	ICA PSV (cm/s)	ICA EDV (cm/s)	PSVica/PSVcca	St Mary's ratio
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<30%	Intimal Thickening	<125	<40		
<30%	Plaque	<125	<40		
<40%	Plaque	<125	<40		
<50%	Plaque	<125	<40	<2	<8
50-59%	Plaque	>125	<40	<3.2	8.0-10
60-69%	Plaque	>125	40-110	3.2-4.0	11-13
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80-89%	Plaque	>230	>140	>4.0	22-29
90-95%	Plaque	>400	>140	>5.0	>30
96-99%	Plaque	Trickle flow			Variable
100%	Plaque	Absence of flow			N/A

Reference:

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