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Duplex Doppler Ultrasound Extracranial Carotid Artery Disease

Approved November 2021

Australasian Society for Ultrasound in Medicine

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1. Introduction

1.1 Purpose

These guidelines for the reporting of extracranial carotid artery disease aim to provide baseline standards to assist those performing and reporting extracranial carotid artery ultrasound examinations.

1.2 Scope

These guidelines for the reporting of extracranial carotid artery disease provide a baseline standard to assist those performing and reporting these examinations.

The threshold values are recommendations only.

These guidelines should not be considered diagnostic criteria in isolation as each individual lab should internally validate their own results if possible.

Other published criteria may have similar validity; these are provided in Appendix A for information.

1.3 Acronyms

ICA	Internal carotid artery
CCA	Common carotid artery
ECST	European Carotid Surgery Trial
NASCET	The North American Symptomatic Carotid Endarterectomy Trial
PSV	Peak systolic velocity
EDV	End diastolic velocity
ICA/CCA	Ratio of ICA PSV to CCA PSV

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2. Guidelines

2.1 Measurements

Stenosis Grade	Interpretation	PSV	EDV	ICA/CCA
0	Normal waveform and image			
< 50% diameter reduction	PSV and ICA/CCA	<125 cm/sec[1,2]		
50 - 69% diameter reduction	PSV and ICA/CCA or only ICA/CCA	>125 cm/sec[3]		> 2[3]
70 - 79% diameter reduction	PSV or EDV or ICA/CCA	>270 cm/sec[4]	>110 cm/sec[4]	> 4[5]
> 80 % diameter reduction	PSV and EDV and ICA/CCA	>270 cm/sec[4]	>140 cm/sec[1]	> 4[5]
95 – 99% Near Occlusion	• Criteria for > 80% reduction may still apply; velocities can be high or low • Correlation with B-mode and colour appearances mandatory, includes string sign			
Occluded	No flow Terminal thump			

2.2 Descriptions

Plaque Classification	Surface	Bifurcation	Tortuosity	Technical
echogenic	smooth	normal	minimal	poor
hypoechoic	irregular	high	moderate	good
mixed	indeterminate	low	maximum	excellent
calcification				
indeterminate				

Evidence suggests greatest benefit from surgery in >70% diameter reduction and possibly >50% stenosis grades but the need for intervention is influenced by patient's symptoms and other factors.

NASCET measurement criteria can be used as supportive evidence.

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3. References

1. Zierler RE, Dawson DL, eds. Strandness's Duplex Scanning in Vascular Disorders. Fifth edition. Wolters Kluwer; 2016.

2. Grant EG, Benson, CB, Moneta GL, et al. Carotid Artery Stenosis: Grayscale and Doppler Ultrasound Diagnosis—Society of Radiologists in Ultrasound Consensus Conference. Ultrasound Q. 2003;19(4):190-198.

3. Oates CP, Naylor AR, Hartshorne T, et al. Joint Recommendations for Reporting Carotid Ultrasound Investigations in the United Kingdom. Eur J Vasc Endovasc Surg. 2009;37(3):251-261. doi:10.1016/j.ejvs.2008.10.015

4. Neale ML, Chambers JL, Kelly AT, et al. Reappraisal of duplex criteria to assess significant carotid stenosis with special reference to reports from the North American Symptomatic Carotid Endarterectomy Trial and the European Carotid Surgery Trial. J Vasc Surg. 1994;20(4):642-649. doi:10.1016/0741-5214(94)90290-9

5. Moneta GL, Edwards JM, Chitwood RW, et al. Correlation of North American Symptomatic Carotid Endarterectomy Trial (NASCET) angiographic definition of 70% to 99% internal carotid artery stenosis with duplex scanning. J Vasc Surg. 1993;17(1):152-159. doi:10.1016/0741-5214(93)90019-I

4. Version history

Version	Date Published	Details
1.0	May 2006	Created.
1.1	Jul 2007	Reaffirmed.
2.0	Mar 2008	Figure labelling and relevant wording in second paragraph changed from NASCET method to ECST method.
3.0	Nov 2021	Figure removed; measurement criteria updated; references included; new Appendix A of alternative published criteria; acronyms moved to beginning of document.

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Appendix A – Alternative Criteria

The following published criteria for reporting of extracranial carotid artery disease may have similar validity to these guidelines.

1. American Institute of Ultrasound in Medicine (AIUM)). Ultrasound Examination of the Extracranial Cerebrovascular System. Published online 2016. Available at: https://www.aium.org/resources/guidelines/extracranial.pdf

2. Grant EG, Benson, CB, Moneta GL, et al. Carotid Artery Stenosis: Grayscale and Doppler Ultrasound Diagnosis—Society of Radiologists in Ultrasound Consensus Conference. Ultrasound Q. 2003;19(4):190-198. Available at: https://pubmed.ncbi.nlm.nih.gov/14500855/

3. Gornik HL, Rundek T, Gardener H, et al. Optimization of duplex velocity criteria for diagnosis of internal carotid artery (ICA) stenosis: A report of the Intersocietal Accreditation Commission (IAC) Vascular Testing Division Carotid Diagnostic Criteria Committee. *Vasc Med*. 2021;26(5):515-525. doi:10.1177/1358863X211011253 Available At: https://pubmed.ncbi.nlm.nih.gov/34009060/

4. Intersocietal Accreditation Commission (IAC). IAC Vascular Testing Communication: Updated Recommendations for Carotid Stenosis Interpretation Criteria. Published online October 2021. Available at: https://intersocietal.org/wp-content/uploads/2021/10/IAC-Vascular-Testing-Communication_Updated-Recommendations-for-Carotid-Stenosis-Interpretation-Criteria.pdf

5. Oates CP, Naylor AR, Hartshorne T, et al. Joint Recommendations for Reporting Carotid Ultrasound Investigations in the United Kingdom. Eur J Vasc Endovasc Surg. 2009;37(3):251-261. doi:10.1016/j.ejvs.2008.10.015 Available at: https://pubmed.ncbi.nlm.nih.gov/19046904/

6. Society of Vascular Ultrasound (SVU). Extracranial Cerebrovascular Duplex Ultrasound. Published online 2019. Available at: https://higherlogicdownload.s3.amazonaws.com/SVUNET/c9a8d83b-2044-4a4e-b3ec-cd4b2f542939/UploadedImages/PPG_Docs/1__Extracranial_Cerebrovascular_Duplex_Ultrasound_Evaluation__Updated_2019_.pdf

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