*These diagnostic criteria references serve as example references only. Inclusion on the website does not imply any endorsement of these criteria by the IAC Vascular Testing Board of Directors or staff, nor does the IAC take any position with regards to the materials presented. Furthermore, inclusion does not indicate that these criteria comply with accreditation requirements. Individual members are responsible for validating the diagnostic criteria specific to their own vascular laboratories.*

# EXTRACRANIAL CEREBROVASCULAR TESTING REFERENCES

## Internal Carotid Artery Stenosis

1. Gornik, HL, Rundek, T, Gardner, H, Benenati, JF, Dahiya, N, Hamburg NM, et al. Optimization Of Duplex Velocity Criteria for Diagnosis of Internal Carotid Artery (ICA) Stenosis: Report of the Intersocietal Accreditation Commission (IAC) Vascular Testing Division Carotid Diagnostic Criteria Committee. *Vascular Medicine 2021;1-11.*

*New for 2025:*

1. Jareczek FJ, Farrell MB, Lehman EB, Sila C, Terry JB, Sacks D, Kalapos P, Simon SD, Cockroft KM. Variation in Carotid Artery Stenosis Measurements Among Facilities Seeking Carotid Stenting Facility Accreditation. Stroke. 2023;54(6):1578-1586.
2. Grant EG, Benson CB, Moneta GL, Alexandrov AV, Baker JD, Bluth EI, et al. Carotid Artery Stenosis: Grayscale and Doppler US Diagnosis – Society of Radiologists in Ultrasound Consensus Conference. *Radiology*, 2003; 340-6.

# INTRACRANIAL CEREBROVASCULAR TESTING REFERENCES

Peer-reviewed publications addressing **indications** and level of evidence for Transcranial Doppler Testing:

1. Sloan MA, Alexandrov AV, Tegeler CH, Spencer MP, Caplan LR, Feldmann E, Wechsler LR, Newell DW, Gomez CR, Babikian VL, Lefkowitz D, Goldman RS, Armon C, Hsu CY, Goodin DS. Assessment: Transcranial Doppler Ultrasonography: Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology,* 2004; 62:1468-81.

Peer-reviewed publications on **how to perform** complete transcranial Doppler examination:

1. Alexandrov AV, Sloan MA, Wong LKS, Douville C, Razumovsky AY, Koroshetz WJ, Kaps M, Tegeler CH. Practice Standards for Transcranial Doppler (TCD) Ultrasound: Part I - Test Performance. *Journal of Neuroimaging*, 2007; 17:11-18.

Peer-reviewed publications on **expected outcomes** of TCD testing:

1. Alexandrov AV, Sloan MA, Tegeler CH, Newell DN, Lumsden A, Garami Z, Levy CR, Wong LK, Douville C, Kaps M, Tsivgoulis G; for the American Society of Neuroimaging Practice Guidelines Committee. Practice Standards for Transcranial Doppler (TCD) Ultrasound: Part II - Clinical Indications and Expected Outcomes. *Journal of Neuroimaging*, 2012; 22:215-224.

*New for 2025:*

1. Kirsch JD, Mathur M, Johnson MH, Gowthaman G, Scoutt LM. 2013. Advances in Transcranial Doppler US: Imaging Ahead. Radio Graphics Vol.33, NO.1. Neurologic/Head and Neck Imaging.  <https://doi.org/10.1148/rg.331125071>

# PERIPHERAL ARTERIAL TESTING REFERENCES

## Indication for Testing

Appropriate Use Criteria Document on arterial testing, consensus statement, multi-societal peer reviewed:

1. Mohler ER 3rd, Gornik HL, Gerhard-Herman M, Misra S, Olin JW, Zierler RE, Wolk MJ. [2012](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Appropriate Use Criteria for Peripheral Vascular Ultrasound and Physiological Testing part I:](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Arterial Ultrasound and Physiological Testing: A Report of the American College of Cardiology](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Foundation Appropriate Use Criteria Task Force, American College of Radiology, American](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Institute of Ultrasound in Medicine, American Society of Echocardiography, American Society of](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Nephrology, Intersocietal Accreditation Commission, Society for Cardiovascular Angiography and](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Interventions, Society of Cardiovascular Computed Tomography, Society for Interventional](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Radiology, Society for Vascular Medicine, Society for Vascular Surgery and Society for Vascular](https://www.ncbi.nlm.nih.gov/pubmed/22694840) [Ultrasound.](https://www.ncbi.nlm.nih.gov/pubmed/22694840) American College of Cardiology, 2012 Jul 17; 60(3):242-76. Erratum in: *Journal of American College of Cardiology*, 2013 Oct 15;62(16):1540.

## Technique

Consensus document on how to measure an ABI:

1. Aboyans V, Criqui MH, Abraham P, Allison MA, Creager MA, Diehm C, Fowkes FG, Hiatt WR, Jönsson B, Lacroix P, Marin B, McDermott MM, Norgren L, Pande RL, Preux PM, Stoffers HE, Treat-Jacobson D; American Heart Association Council on Peripheral Vascular Disease; Council on Epidemiology and Prevention; Council on Clinical Cardiology; Council on Cardiovascular Nursing; Council on Cardiovascular Radiology and Intervention, and Council on Cardiovascular Surgery and Anesthesia. [Measurement and Interpretation of the Ankle-Brachial Index: A Scientific](https://www.ncbi.nlm.nih.gov/pubmed/23159553) [Statement from the American Heart Association.](https://www.ncbi.nlm.nih.gov/pubmed/23159553) *Circulation*, 2012 Dec 11;126(24):2890-909

## Quantification of Lower Extremity Stenosis

Early systematic review on ultrasound criteria for quantifying lower extremity arterial stenosis with ultrasound:

1. Koelemay MJW, Den Hartog D, Prins MH, Kromhout JG, Legemate DA, Jacobs MJHM. Diagnosis of Arterial Disease of the Lower Extremities with Duplex Ultrasonography. *British Journal of Surgery*, 1996;83(3):404-409. ISSN 1365-2168.
2. Crawford, J.D., Robbins, N.G., Harry, L.A., Wilson, D.G., McLafferty, R.B., Mitchell, E.L., Moneta, G.L. Characterization of Tibial Velocities by Duplex Ultrasound in Severe Peripheral Arterial Disease and Controls. *Journal of Vascular Surgery*, 2016; 63(3), 646-651.

## Consensus statement of ASE and SVM including components of testing and technique:

1. Gerhard-Herman M, Gardin J, Jaff M, Mohler E, Roman M, Naqvi T. Guidelines for Noninvasive Vascular Laboratory Testing: A Report from the American Society of Echocardiography and the Society of Vascular Medicine and Biology. *Journal of the American Society of Echocardiography*, 2006 August;19(8):955-972.

**Upper extremity** reference on subclavian stenosis duplex validation vs. CT or conventional angiography:

1. Mousa AY, Morkous R, Broce M, Yacoub M, Sticco A, Viradia R, Bates MC, AbuRahma AF. Validation of Subclavian Duplex Velocity Criteria to Grade Severity of Subclavian Artery Stenosis. *Journal of Vascular Surgery*, 2017 June; 65(6):1779-1785.

**Criteria on physiologic and non-invasive imaging** of peripheral arterial disease. Multi-societal position statement:

1. Dhanoa D, Baerlocher MO, Benko AJ. Position Statement on Noninvasive Imaging of Peripheral Arterial Disease by the Society of Interventional Radiology and the Canadian Interventional Radiology Association. *Journal of Vascular Interventional Radiology*, 2016;27:947-951.

Peer reviewed protocol on ultrasound evaluation of **arterio-venous fistula**:

1. Teodorescu V, Gustavson S, Schanzer H. Duplex Ultrasound Evaluation of Hemodialysis Access: A Detailed Protocol. *International Journal of Nephrology*, 2012; Article ID 508956: 7 pages.

Chapter on vascular testing including quality including **methodology**:

1. AbuRahma A., Perler, B. Non-Invasive Vascular Diagnosis: A Practical Guide to Therapy, 5th Edition. New York: Springer Dordrecht Heidelberg; 2017.

# PERIPHERAL VENOUS TESTING REFERENCES

## Indication for Testing

Appropriate Use Criteria Document on venous testing, consensus statement, multi-societal peer reviewed:

1. [Gornik HL,](https://www.ncbi.nlm.nih.gov/pubmed/?term=Gornik%20HL%5BAuthor%5D&cauthor=true&cauthor_uid=23876422) [Gerhard-Herman MD,](https://www.ncbi.nlm.nih.gov/pubmed/?term=Gerhard-Herman%20MD%5BAuthor%5D&cauthor=true&cauthor_uid=23876422) [Misra S,](https://www.ncbi.nlm.nih.gov/pubmed/?term=Misra%20S%5BAuthor%5D&cauthor=true&cauthor_uid=23876422) [Mohler ER,](https://www.ncbi.nlm.nih.gov/pubmed/?term=Mohler%20ER%203rd%5BAuthor%5D&cauthor=true&cauthor_uid=23876422) [Zierler RE.](https://www.ncbi.nlm.nih.gov/pubmed/?term=Zierler%20RE%5BAuthor%5D&cauthor=true&cauthor_uid=23876422) [Peripheral Vascular](https://www.ncbi.nlm.nih.gov/pubmed/?term=Peripheral%20Vascular%20Ultrasound%20and%20Physiological%20Testing%20Part%20II%3A%20Testing%20for%20Venous%20Disease%20and%20Evaluation%20of%20Hemodialysis%20Access%20Technical%20Panel%5BCorporate%20Author%5D) [Ultrasound and Physiological Testing Part II: Testing for Venous Disease and Evaluation of](https://www.ncbi.nlm.nih.gov/pubmed/?term=Peripheral%20Vascular%20Ultrasound%20and%20Physiological%20Testing%20Part%20II%3A%20Testing%20for%20Venous%20Disease%20and%20Evaluation%20of%20Hemodialysis%20Access%20Technical%20Panel%5BCorporate%20Author%5D) [Hemodialysis Access Technical Panel](https://www.ncbi.nlm.nih.gov/pubmed/?term=Peripheral%20Vascular%20Ultrasound%20and%20Physiological%20Testing%20Part%20II%3A%20Testing%20for%20Venous%20Disease%20and%20Evaluation%20of%20Hemodialysis%20Access%20Technical%20Panel%5BCorporate%20Author%5D); [Appropriate Use Criteria Task Force](https://www.ncbi.nlm.nih.gov/pubmed/?term=Appropriate%20Use%20Criteria%20Task%20Force%5BCorporate%20Author%5D); ACCF/ACR/AIUM/ASE/IAC/ SCAI/SCVS/SIR/SVM/SVS/SVU 2013 Appropriate Use Criteria for Peripheral Vascular Ultrasound and Physiological Testing Part II: Testing for Venous Disease and Evaluation of Hemodialysis Access: A Report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force. [*Journal of American College of Cardiology*,](https://www.ncbi.nlm.nih.gov/pubmed/23876422) 2013 Aug 13; 62(7):649-65. doi: 10.1016/j.jacc.2013.05.001. Epub 2013 Jul 19.

## Venous Patency

Peer-reviewed publication review article on noninvasive venous testing interpretation:

1. Barleben A, Bandyk DF. Interpretation of Peripheral Venous Testing. *Seminars in Vascular Surgery*, 2013; 26 (2-3):111-119, WB Saunders.

Peer-reviewed publication review of venous ultrasound interpretation with case examples:

1. Gornik HL, Sharma AM. Duplex Ultrasound in the Diagnosis of Lower-Extremity Deep Venous Thrombosis. *Circulation*, 2014; 129:917-921.

Peer-reviewed publication review of venous Doppler waveforms with case examples:

1. Selis JE, Kadakia S. Venous Doppler Sonography of the Extremities: A Window to Pathology of the Thorax, Abdomen and Pelvis. *American Journal of Roentgenology*, 2009; 193:1446-1451.

## Venous Insufficiency

Peer-reviewed publication of chronic venous disease practice guidelines with diagnostic techniques and interpretive criteria:

1. Gloviczki P, Comerota AJ, Dalsing MC, Eklof BG, Gillespie DL, Gloviczki ML, Lohr JM, McLafferty RB, Meissner MH, Murad MH, Padberg FT, Pappas PJ, Passman MA, Raffetto JD, Vasquez MA, Wakefield TW. The Care of Patients with Varicose Veins and Associated Chronic Venous Diseases: Clinical Practice Guidelines of the Society for Vascular Surgery and the American Venous Forum. *Journal of Vascular Surgery*, 2011; 53:2S-48S.

Peer-reviewed publication review article of venous imaging techniques and criteria:

1. Khilnani NM, Min RJ. Imaging of Venous Insufficiency. *Seminars in Interventional Radiology*, 2005; 22(3):178-184, Thieme Medical Publishers.

Peer-reviewed publication prospective study on ultrasound measurement of retrograde venous flow:

1. Labropoulos N, Tiongson J, Pryor L, Tassiopoulos AK, Kang SS, Mansour A, Baker WH. Definition of Venous Reflux in Lower-Extremity Veins. *Journal of Vascular Surgery*, 2003; 38:793-798.

## Venous Mapping

Peer-reviewed publication review of pre-operative ultrasound criteria for fistula creation:

1. Ferring M, Henderson J, Wilmink A, Smith S. Vascular Ultrasound for the Pre-Operative Evaluation Prior to Arteriovenous Fistula Formation for Haemodialysis: Review of the Evidence. *Nephrology Dialysis Transplant*, 2008; 23:1809-1815.

Peer-reviewed publication of prospective study on benefits of vein mapping for infrainguinal bypass:

1. Linni K, Mader N, Aspalter M, Butturini E, Ugurluoglu A, Hitzl W, Holzenbein TJ. Ultrasonic Vein Mapping Prior to Infrainguinal Autogenous Bypass Grafting Reduces Postoperative Infections and Readmissions. *Journal of Vascular Surgery*, 2012; 56:126-133.

Peer-reviewed publication evaluating vein mapping technique and diameters with fistula creation:

1. Lockhart ME, Robbin ML, Fineberg NS, Wells CG, Allon M. Cephalic Vein Measurement Before Forearm Fistula Creation. *Journal of Ultrasound Medicine*, 2006; 25:1541-1545.

# VISCERAL VASCULAR TESTING REFERENCES

## Renal

1. Abu Rahma AF, Srivastava M, Mousa A, et al. Critical Analysis of Renal Duplex Ultrasound Parameters in Detecting Significant Renal Artery Stenosis. *Journal of Vascular Surgery*, 2012; 56:1052-1059, 1060.e1051; discussion 1059-1060.

This is a recent large peer-reviewed review of current diagnostic criteria

1. Taylor DC, Kettler MD, Moneta GL, et al. Duplex Ultrasound Scanning in the Diagnosis of Renal Artery Stenosis: A Prospective Evaluation. *Journal of Vascular Surgery*, 1988; 7:363-369

This is the classic peer-reviewed publication that defined duplex criteria for renal artery stenosis.

1. Williams GJ, Macaskill P, Chan SF, et al. Comparative Accuracy of Renal Duplex Sonographic Parameters in the Diagnosis of Renal Artery Stenosis: Paired and Unpaired Analysis. *American Journal of Roentgenology*, 2007; 188:798-811

This is a comprehensive peer-reviewed meta-analysis of the duplex criteria for renal artery stenosis.

## Mesenteric

1. Abu Rahma AF, Stone PA Srivastava M, et al. Mesenteric/Celiac Duplex Ultrasound: Interpretation Criteria Revisited. *Journal of Vascular Surgery*, 2012; 55: 428-36.

This is a peer-reviewed study with the largest number of duplex/angiography correlations to assess diagnostic criteria for celiac and SMA stenosis.

1. Moneta GL, Yeager RA, Dalman R, et al. Duplex Ultrasound Criteria for Diagnosis of Splanchnic Artery Stenosis or Occlusion. *Journal of Vascular Surgery*, 1991; 14:511-20.

This is the classic peer-reviewed publication with validation of mesenteric artery stenosis criteria.

1. Pellerito JS, Revzin MV, Tsang JC, Greben CR, Naidich JB. Doppler Ultrasound Criteria for the Diagnosis of Inferior Mesenteric Artery Stenosis. *Journal of Ultrasound Medicine*, 2009; 28:641- 650.

Few studies have included the IMA in their discussion of chronic mesenteric insufficiency. This is a recent peer-reviewed study with identification of duplex criteria for inferior mesenteric artery stenosis.

# GENERAL REFERENCES

Widely regarded texts with multiple editions on vascular ultrasound:

1. Pellerito JS, Polak JF. Introduction to Vascular Ultrasonography, 7th Edition. Elsevier, 2012.
2. Zierler RE, Dawson DR, Strandness’s Duplex Scanning in Vascular Disorders, 5th Edition. Wolters Kluwer, 2016.
3. Kupinsky AM. The Vascular System: Diagnostic Medical Sonography Series, 2nd Edition. Wolters Kluwer, 2018.
4. Kim E, Sharma A, Scissons R, Dawson D, Eberhardt R, Gerhard-Herman M, Hughes J, Knight S, Kupinski AM, Guillaume M, Neumyer M, Poe P, Shugart R, Wennberg P, Williams D, Zierler E, Interpretation of Peripheral Arterial and Venous Doppler Waveforms: A Consensus Statement from the Society for Vascular Medicine and Society for Vascular Ultrasound. *Journal for Vascular Ultrasound*, 2020; 44.154431672094309.