

Diagnostic Ultrasound in Neurology, Neurosurgery and Intensive Care

Andrei V. Alexandrov, MD

Semmes Murphey Professor and Chairman

Department of Neurology, University of Tennessee Health Science Center

Medical Director, City-wide Stroke Team and Mobile Stroke Unit, Memphis, TN

Carotid/vertebral duplex, transcranial duplex and transcranial Doppler are widely applicable and established tests for screening steno-occlusive disease, diagnosis of recanalization and re-occlusion, cerebral embolism in real time, right-to-left shunts, cerebral circulatory arrest as well as monitoring of surgeries, stenting, vasomotor reactivity and vasospasm.

Mastering cerebrovascular ultrasound tests requires in depth training in applied principles of ultrasound physics, cerebral and central hemodynamics, and disease-specific applications across multiple neurological, neurosurgical and neuro-critical care settings.

Benefits of cerebrovascular ultrasound testing include grading clinically relevant strata of carotid artery stenosis, vertebro-basilar lesions, intracranial steno-occlusive disease as well as detection, quantification and localization of cerebral embolism, assessment of collaterals and intracranial steal phenomenon (reversed Robin Hood syndrome), dynamic changes in brain perfusion in response to intensive care and interventions for vasospasm after subarachnoid hemorrhage, acute ischemic stroke treatment, and revascularization procedures.

Future directions include teaching medical students principles of ultrasound and evaluation of anatomy and physiology using ultrasound tests. Early career exposure to ultrasound should enable clinicians to master complex bedside cerebrovascular tests during residency in and fellowship training. I use the abovementioned tests during my rounds as an extension of my neurological examination making this assessment a neurovascular examination aimed at detecting and localizing vascular problems and ascertaining pathophysiological mechanism of brain injury in real time at bedside.