Comparison of the Carotid Stenosis Index With CT Angiography

To the Editor:

The optimal method for measurement of carotid stenosis remains something of an enigma. Large randomized control trials in symptomatic and asymptomatic carotid stenosis have been based on standardized measurements of carotid stenosis derived from digital subtraction angiography and/or duplex ultrasound. Accordingly, there have been various methods used to measure percent stenosis (NASCET, ECST), as well as others (common carotid method, carotid stenosis index [CSI]), each with its own shortcomings. These indirect techniques use surrogate measures to determine the denominator in carotid stenosis calculations, such as the distal internal carotid artery or estimation of carotid bulb diameter by vascular anatomical ratios. Of these techniques, rightly of clinical use today, 5

Indirect measurement techniques such as the NASCET method carry a reassuring degree of certainty. Overall, the measurement process is well understood, using defined anatomical locations, with correlation to the most common technique used today: duplex ultrasound. This leads to a reasonable level of consistency across serial measurements within a patient, and for research across trial centers. The results of intervention studies in carotid stenosis are, therefore, broadly comparable and, hopefully, lead to an acceptable degree of external validity for the practicing clinician.6,7

The rationale for our development of the CSI was to reduce the variability of measurement of carotid stenosis. The CSI method compares stenosis diameter to the diameter of the widest part of the carotid bulb. This is established by derivation from the anatomical ratio of the diameter of the common carotid artery to the carotid bulb (1.2 X CCA diameter = carotid bulb diameter). The CSI was validated against plaque planimetry and ultrasound with excellent inter- and intraobserver variability.4

Bartlett et al have now harnessed the inevitable advances in imaging technology and have used computed tomography angiography (CTA) to directly measure carotid stenosis using screen calipers applied to contrast luminograms of the carotid bulb. Their message seems to be that measurements of carotid stenosis should be direct and individualized, not generalized, by CTA measurement of the diameters of the carotid bulb and the atheromatous stenosis. However, CTA is not without technological difficulties. The carotid bulb vessel wall is not directly enhanced and may be difficult to identify clearly from the variable density of adjacent plaque and tissue calcification. As the authors note, using CTA indeed involves a new measurement paradigm for carotid stenosis.

The authors attempt at comparison with the CSI method falls short because of the methodology used. Critically, the CTA measurements (carotid bulb stenosis and carotid bulb diameter) are made on contrast luminogram axial images at the level of tightest stenosis, ie, both the stenosis and the carotid bulb diameter are measured at the same location. In contrast, the CSI method is designed to give an estimate of the carotid bulb diameter at the widest point of the carotid bulb, not at the tightest point of the stenosis. Depending on where the stenosis is located the bulb diameter measurement at that point may differ significantly compared with that using the carotid bulb diameter at its widest point (CSI method). It is therefore not surprising that the results presented of percent stenosis measurements using CTA significantly differ to those derived from using CSI. The authors do not give actual measurements for CCA diameter, only the discrepancy between CSI bulb method and direct CTA measurement method.

For a true comparison of the CTA and CSI methods, it would be helpful if comparison is made to carotid plaque planimetry. Attempting such precision in carotid stenosis measurement is not necessarily a bad thing (and indeed is probably inevitable) but caution must be exercised. The results of randomized control trials for treatment of carotid stenosis are only directly applicable when based on the method of measurement used in the particular trial. For example, when making decisions for individual patients whose carotid stenosis has been measured using CTA the results of symptomatic carotid trials (NASCET, ECST), and in particular the measurement cut-off guidelines for considering treatment (eg, less than, or greater than, 70% stenosis), cannot be reliably applied.6,7

The CTA method of measuring carotid stenosis has much to recommend it. It is fast, efficient, with less radiation than digital subtraction angiography and clearly represents an advance in noninvasive carotid imaging. However, many questions remain before CTA is ready to supplant carotid ultrasound and is considered fully validated for use in routine clinical practice.

Disclosures

None.

Christopher Bladin, MD, FRACP
Eastern Melbourne Neurosciences
Box Hill Hospital (Monash University)
Melbourne, Australia

Andrei V. Alexandrov, MD
Comprehensive Stroke Center
The University of Alabama Hospital
Birmingham Alabama, USA
John Norris, MD, FRCP
St Georges Hospital Medical School
Department of Clinical Neurosciences
St Georges Hospital
London, UK

2. European Carotid Surgery Trialists’ Collaborative Group. MRC European carotid surgery trial: interim results for symptomatic patients with severe (70–99%) stenosis or with mild (0–29%) stenosis. Lancet. 1991;337:1235–1244.