

Extracranial carotid ultrasound examination: is everything really clear?

N. Carraro

Department of Neurology, Cattinara Hospital, Trieste, Italy
E-mail: n.carraro@fmc.units.it

One of the most common criticisms of the extracranial carotid ultrasound (ECUS) examination is that it is operator-dependent and thus cannot be considered basically reliable. For this reason angio-CT and angio-MR scans are used as confirmatory evaluations before carotid endarterectomy or stenting.

Nowadays, fortunately, the relative weight of this examination is declining since all the new technologies give good or excellent quality images, making it possible to obtain vessel characteristics and flow velocity values.

All investigation techniques, angio-CT and angio-MR included, have some limitations. In the case of ECUS, it is the fact that calcium-rich lesions generate dense shadows that prevent the examiner from obtaining morphological and flow velocity data. Furthermore, anatomical variants like “far bifurcation” or artery course variations, may result in difficult or occasionally inaccurate diagnostic interpretation of the examination. However, these borderline cases apart, ECUS yields elements that, if homogeneously taken into account, make the global evaluation less operator-dependent.

Many criteria for evaluating carotid stenosis have been proposed by different angiography-based studies like NASCET, ECST and CSI; their view is that ECUS, owing to its peculiar capacity to give not only morphometric but also velocimetric data, cannot simply be overlooked.

Moreover, we must remember that during the atherosclerotic process, arteries enlarge (positive remodeling) in relation to the build-up of the plaque and that a functionally relevant lumen stenosis may not occur until the lesion occupies 40 percent, or more, of the internal elastic lamina area (1). It is only from this point that the growth of the plaque leads to a real lumen reduction (negative remodelling), finally inducing a haemodynamically significant lesion. It is therefore not surprising to find lesions of a considerable size without any flow velocity increase.

In 2003, the Society of Radiologists in Ultrasound convened a multidisciplinary panel of experts, in the field of vascular ultrasonography (US), to reach a consensus about the role of Doppler US in the diagnosis of carotid artery stenosis. It was stated that the degree of stenosis determined on grey-scale and Doppler US should be stratified into the following categories: normal (no stenosis), <50% stenosis, 50%-69% stenosis, >70% stenosis to near occlusion, near occlusion, and total occlusion (2). Internal carotid artery (ICA) peak systolic velocity (PSV) and the presence of plaques on grey-scale and/or colour Doppler images are primarily used in the diagnosis and grading of ICA stenosis, and two additional parameters, ICA/common carotid artery PSV ratio and ICA end-diastolic velocity, may also be used if clinical or technical factors suggest that ICA PSV may not be representative of the real degree of disease. These parameters may also be useful when calcium deposits prevent good imaging of the plaque. To date, no ultrasonographic definition of a near occlusion lesion has been advanced; on the contrary there are radiological parameters.

Widespread use of this categorisation requires homogeneous collection of the evaluative elements and less variability in quantifying the degree of stenosis; moreover, it should also be permissible to draw diagnostic conclusions even if some tough data like the morphometric measures, owing to the plaque characteristics (type 5 plaques), are lacking.

On the other hand, it is sometimes found that all these elements do not fit into a complete, accepted classification, and that there may be other relevant elements, such flow characteristics after stenosis, where the flow may be disrupted, presenting marked turbulence or severe reduction. Another intriguing question is whether only the degree of stenosis is relevant to defining a plaque as at risk, or whether other plaque characteristics may play an important role.

References

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