Imaging assessment of carotid artery stenosis varies in clinical practice

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RESEARCH LETTER

Imaging Assessment of Carotid Artery Stenosis Varies in Clinical Practice

Following landmark trials, carotid endarterectomy (CEA) has proven to be beneficial in neurologically symptomatic patients with a carotid artery diameter reduction of ≥50% on digital subtraction angiography, excluding near occlusions.[1] The standard quantification method to assess the degree of carotid artery stenosis is to determine the diameter reduction. Currently, the diameter reduction method has been applied to computed tomography angiography (CTA) and magnetic resonance angiography images. However, this method might not be optimal for assessment of stenosis with irregular plaques as the area of the residual lumen is often asymmetric.[2] Alternatively, measurement of the cross sectional area on CTA takes the asymmetric shapes of a stenosis into account, as confirmed by studies that suggest that measurement of cross sectional area reduction might provide a more accurate estimate of the degree of stenosis, especially for irregular plaques.[2—4] In a completely concentric stenosis, the reduction in lumen diameter can be directly translated to the reduction in cross sectional area (50% diameter reduction correlates with 75% area reduction).[3] In contrast, there are also suggestions that there is overall no significant difference between diameter and area reduction of carotid artery stenosis on CTA.[5] However, there is currently no consensus to what extent measurement of cross sectional area reduction differs from measurement of diameter reduction in a clinical setting.

In daily clinical practice, some radiologists already measure cross sectional area reduction to determine the degree of stenosis, but it is unclear to what extent this occurs. Therefore, a questionnaire was generated to evaluate which method radiologists use preferentially, and distinguished three types of plaque: regular/non-ulcerated, irregular/ulcerated, and calcified. This questionnaire was made available to visitors to the 41st annual meeting of the European Society of Neuroradiology held in the Netherlands in September 2018. One respondent was excluded for not answering all three questions in order to determine the method used regarding the type of plaque. The answers of 92 respondents (83 neuroradiologists, eight neuroradiology residents, and one neurosurgeon) were analysed. The questionnaire based survey had several limitations. For instance, selection and response bias may have occurred as the majority of respondents (73%) were practising in Europe, 17% of whom were from the Netherlands, and the response rate was unknown. Therefore, the percentages generated in this survey must be considered with caution. Furthermore, the method of measurement (manual or [semi-]automated) was not specified.

The method used to assess the degree of carotid artery stenosis in this survey varied according to the type of plaque (Table 1). The diameter reduction method is used most often in regular/non-ulcerated and calcified plaques (67% and 62%, respectively). However, the cross sectional area reduction method is also used, especially in irregular/ulcerated plaques (45%; either using the area reduction method exclusively or using both the diameter and area reduction methods). The area reduction method was used as the sole method for an irregular/ulcerated plaque in 32%. The results of the questionnaire are remarkable. The current guideline does not consider measuring area reduction to be an option for determining the degree of stenosis.[1] Although it is unclear to what extent measurement of the area reduction differs from measurement of the diameter reduction, in individual patients it is clear that the degree of carotid artery stenosis can vary depending on which method is used.[2—5] Consequently, it may affect decision making for patient eligibility for CEA; some patients may undergo CEA unnecessarily owing to the variability in measurements between the diameter and area reduction. Also, conversely, some patients might be deprived of CEA unnecessarily.

This questionnaire based survey shows that the quantification method of carotid artery stenosis on CTA varies according to the type of plaque, and includes measurement of area reduction, in particular for irregular/ulcerated plaques. To select patients for CEA the area reduction method should be used with caution, because the relationship between the results of cross sectional area reduction and diameter reduction measurement remains unclear. Although the area reduction method seems promising, there is currently no evidence for using this method to select patients for CEA and this method needs validation before it can be implemented for use in clinical practice.

FUTURE PERSPECTIVE

Despite variation in the method used to determine carotid stenosis as shown in this survey, it is believed area

Table 1. Overview of the quantification method used by the 92 respondents to determine the degree of carotid artery stenosis, according to each type of plaque

Quantification method	Regular/non-ulcerated plaques	Irregular/ulcerated plaques	Calcified plaques
Diameter reduction	62 (67)	49 (53)	57 (62)
Area reduction	18 (20)	29 (32)	22 (24)
Both (diameter and area reduction)	11 (12)	12 (13)	9 (10)
No answer	1 (1)	2 (2)	4 (4)

Data are presented as *n* (%). Seven different respondents did not answer one of three questions according to the type of plaque.

reduction measurement should be the preferred method to determine the degree of stenosis as there is evidence that this method is more accurate than the diameter reduction method, especially for irregular plaques.[2–4] However, firstly, consensus should be reached if measurement of cross sectional area reduction differs from measurement of diameter reduction in a clinical setting, and, secondly, future studies must show whether new cutoff values should be determined when using the area reduction method to identify patients that will benefit from carotid de-obstruction.

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