

Carotid Imaging: A Vascular Surgeon's Perspective

BY DOUG MASSOP, MD

The evaluation and treatment of carotid and cerebrovascular diseases is obviously in a state of rapid evolution. In the mid-1990s, a large body of literature was devoted to the evaluation of these patients and the practice of performing endarterectomy based solely on carotid duplex ultrasound. However, we have seen significant development in the availability, utility, and accuracy of computed tomography angiography (CTA) and magnetic resonance angiography (MRA). Formal arch and carotid angiography has also made significant strides in the safety and accuracy of this procedure with the development of lower-profile sheaths and catheters, new contrast agents, improved imaging systems, and further development of operator skills. We are left facing questions such as: what is the ideal means of patient evaluation, what is the optimal imaging algorithm, what is the optimal procedural treatment of these patients (considering the best medical therapy vs traditional open surgery vs an endovascular approach), and what level of experience in all of these modalities is necessary to help the patient, family, and referring physician to make an informed decision? The answers to these questions have significantly evolved over the past few decades and will continue to do so as imaging and treatment technology continues to improve. However, we are all faced at the present time with real patients with real clinical situations that deserve the best consultation that we can offer.

For example, in a 60-year-old patient with good medical risk for surgery who has a clear-cut TIA neurologic event from a carotid stenosis, in whom a quality carotid duplex has demonstrated that the patient only has a high-grade stenosis in the appropriate carotid and no clinical evidence of disease elsewhere (ie, no diabetes, equal arm pressures, no bruit in the root of the neck, no prior heart surgery), performing carotid endarterec-

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tomy on the basis of duplex alone is acceptable in this clinical setting. It is not necessary to subject the patient to the inconvenience, risks, and costs associated with additional rounds of testing before proceeding to carotid endarterectomy.

DETERMINING A RISK-ASSESSMENT ALGORITHM

The treating physician must find it necessary to form an algorithm to evaluate the risk of medical therapy versus traditional surgery versus the risk of an endovascular procedure in a particular institution and medical community, based on what and who is available to participate in the evaluation and treatment. Obviously, there are certain patients in whom the degree of disease is difficult to determine. In these patients, advanced imaging modalities, such as CTA or MRA, are particularly helpful in determining treatment risk/benefit ratios. Symptomatic patients who are clearly very high risk for surgery fall into more SAPHIRE-type inclusion criteria (high-risk symptomatic patient), and can be evaluated simply by using angiography; the cost and time expenditure associated with CTA and MRA are not necessary in these cases. Hopefully, the patient can proceed to endovascular treatment at that same setting if clinically indicated.

Some currently used algorithms, however, are not sensible in terms of how patients proceed through a health care system, both from a logistical and a financial

standpoint. The goal should be to do what is most appropriate for the patients and their families—to efficiently evaluate their disease and treat it in order to prevent stroke. If initially performing a carotid duplex ultrasound always leads to administering contrast for performing a CTA, and this always leads to the risk and cost of performing digital subtraction angiography, this will not be justified in the long-term. As you continuously determine and evaluate factors such as age, medical comorbidities, symptoms, and results of physical examination, you can begin to develop an algorithm of the elements that will impact the treatment procedure and the ways in which each affects the overall quality of outcome.

EVOLVING IMAGING STANDARDS

Traditionally, vascular surgeons have been extensively involved in the development and certification of vascular labs. In the 1990s, there was a trend toward less angiography and more treatment based on duplex ultrasound criteria. When comparing the safety and risk profile of angiography based on where the modality was in the 1980s (ie, larger-diameter catheters, stiffer shafts, and a slightly higher risk of access site and evaluation target complications), there was a higher risk of bleeding and stroke associated with angiography. Contemporary angiographic evaluation and therapy seems to carry a lower risk because of smaller diameter, softer catheters. Improved technique is making angiography a safer procedure. It is safer to perform angiography now than it was 20 years ago due to decreased risk of access problems, contrast-related problems, and the risk of embolization and stroke.

In the future, it will be very difficult to justify performing cerebrovascular interventions with a mobile C-arm from a quality standpoint. It is possible to use a mobile C-arm in a start-up phase, but optimal imaging is obtained with dedicated fixed units. Bi-plane units with larger field image intensifiers are preferable if they are available to the operator. Because of the ability to gather more information with minimal contrast and enhanced abilities to both postprocess the image and to take measurements, fixed units are superior. A significant advantage of the fixed systems is the knowledgeable hospital staff that frequently accompanies them. We continue to see significant development in all imaging systems, whether it is duplex ultrasound, CTA, MRA, or digital subtraction angiography. The main advancement in imaging will be improvements in multi-slice CT scanner technology. This will be easily available in most community settings, the diagnostic accuracy will increase, and the cost will ultimately decrease. The

new 64-slice CT scanners are being implemented in many communities at this time.

TRAINING AND CREDENTIALING FOR CAROTID STENTING

The SCAI/SVS consensus document is gaining a large amount of support and will probably provide the basis for credentialing in many hospitals. The fundamental tenets describe a certain level of competence and experience with general endovascular skills, and one should feel comfortable with long catheter wire combinations. As the technology develops completely to monorail systems, an important prerequisite is to be skilled with these systems. Specific guidelines are controversial regarding the number of carotid angiograms and carotid interventions necessary before the operator proceeds on their own. However, the requirements defined in the SCAI/SVS document include 30 angiograms and 25 interventions, and these requirements seem to be very reasonable and are gaining support.

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Credentialing is a hospital function that is decided upon locally in individual communities based on the standard of care in each. Certain societal recommended guidelines are the reasonable starting points.

EMBOLIC PROTECTION

Some interventionalists still support the concept of cervical carotid interventions being routinely performed without cerebral protection. There is ample literature indicating that embolic protection improves results when it is anatomically safe to do so. Clearly, cerebral protection is not a risk-free maneuver; there are anatomical considerations (access anatomy, tortuosity, high-risk lesion characteristics, and fibromuscular or atherosclerotic disease of the distal artery) that are part of the risk/benefit ratio that should be considered when determining how the patient would best be treated. Earlier studies of angiography without protection showed that reasonable results can be obtained without embolic protection. However, to obtain excellent results that can compete with carotid endarterectomy and decrease the complication rate from the 8% to 15% range without protection to the 1% to 2% range with protection, cerebral protection is required. The possible

exception to this is treating ostial lesions off the aortic arch, which in our practice have been safely treated percutaneously without cerebral protection.

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LOOKING FORWARD

According to some endovascular specialists, there is a sense that we will proceed in the next 1 to 2 years to a point when 90% or more of carotid disease will be treated with angioplasty and stenting. This concept is aggressively optimistic. More trials need to be completed that assess the risk/benefit ratio in a broad range of clinical scenarios. We currently have one randomized trial (SAPPHIRE), which demonstrates that in high-risk

patients that there is a clear benefit of angioplasty and stenting. We do not yet know how the procedure applies to the general population of patients with carotid lesions. More information is needed to justify forms of endovascular treatment in a wider range of clinical situations than just the high-risk subset of patients. The various physicians' disciplines treating cerebrovascular diseases have much to learn from each other in terms of characterizing stroke syndromes, lesions, various anatomic combinations (access and treatment locations), and the safety and long-term efficacy of various treatment options. As diagnostic and treatment technology continues to improve, we will learn more about what is the most appropriate choice for individual patients. ■

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