Carotid Imaging: A Neuroradiologist's Perspective

BY KIERAN P. MURPHY, MD

At Johns Hopkins, we perform 2,400 interventional neuroradiology procedures each year, and approximately 1,100 of these interventions are diagnostic cerebral angiograms. All patients undergoing diagnostic cerebral angiography, however, have already had a combination of ultrasound computed tomography (CT) or magnetic resonance (MR) imaging of their neurovasculature performed before they ever see us. We review those studies and determine if it is appropriate to proceed to exposing the patient to the risk of cerebral angiography, although the risk in our hands is well less than 1%. If we do intervene, the procedure is most often performed in a second session; we do not perform diagnostic angiography and the intervention on the same day unless there is some acute need to do so, because I believe that this should require a different type of informed consent. We schedule the intervention for a second day and, in the intermediary period, we are often able to come up with a different plan than what we came up with previously. The added time gives us the opportunity to determine the best plan for that patient and to assemble consensus intervention strategies among our neurologists and neurosurgeons.

We evaluate each of the available options: endarterectomy, stenting, and/or a variety of medical therapies, or no intervention at all. We should not underestimate the power of aspirin, Lipitor, and ACE inhibitors to remodel stenosis and modify the risk/benefit ratio of any intervention in the setting of asymptomatic stenosis. Carotid endarterectomy is an excellent procedure in the hands of a talented and knowledgeable surgeon. For this reason, any patient with carotid stenosis is reviewed by physicians from either our neurosurgery or vascular surgery departments. We decide on the best intervention based on consensus and involve a neurologist to determine if it is appropriate to intervene at all. Just because we see it, doesn't mean we fix it. Some facilities perform the diagnosis and the intervention in the same day; the trend is to address the disease as quickly as possible. In our experience, however, the risk/benefit ratio suffers under such conditions.

> "Any patient with carotid stenosis is reviewed by physicians from either our neurosurgery or vascular surgery departments."

STAFFING AND PREPARATORY CONSIDERATIONS

If a patient is scheduled to undergo carotid stenting, the procedure is performed with anesthesia present; the interventionist should not be required to be managing the patient while working within the vessel. Every member of the procedural staff must know what is and may be expected of them during every type of procedure. The patient is premedicated with aspirin and clopidogrel for several days beforehand. I will cancel an elective procedure if the patient is not premedicated with antiplatelets. We always have an ICU bed array available for them for that afternoon and the day after the procedure. Carotid stenting is always performed at the beginning of the day, usually under conscious sedation, but sometimes under general anesthesia.

We may or may not use distal flow protection, because often the vessels we deal with are so small and diseased that it is not possible to use the protection device safely, and it is best to proceed without it. In fact, I would estimate that 90% of our carotid stenting is performed without distal flow protection. It is dangerous to operate under the belief that distal flow protection is absolution from bad technique and inexperience. Distal flow protection is

perhaps a flawed technology; it is clear that even the benefit of distal flow protection is in doubt. It would have taken 8,000 patients to demonstrate a difference between stenting with and without using distal flow in the ARCHeR study.

CEREBRAL ANGIOGRAPHY

It is inadequate to review only the cervical portion of the carotid angiogram. The individual who performs the cerebral angiogram is responsible for the interpretation of all the findings on the cranial portion of that study. The development of adequate diagnosis and evaluation skills requires a 2-year neuroradiology fellowship focused on such training; without expertise of this level, a misinterpretation of diagnostic cerebral angiography could occur. The findings can very subtle, and unless properly reviewed, there could be a higher incidence of missed aneurysms, arteriovenous malformations, and dural arteriovenous fistulas. Angiographic evaluations, if performed by individuals who do not possess the necessary experience and skill, have the potential to invite substantial malpractice lawsuits. The physician performing the angiogram is responsible for everything on the angiogram. We must be cognizant of this possibility, as ignoring it will likely create a goldmine for attorneys.

Some may say that duplex, MR, and CT are not adequate for carotid imaging, and therefore they go straight to angiography. In our neuroscience group, however, angiography is the last resort and is considered something of a tiebreaker conducted after the patient is screened. In patients who appear normal on ultrasound, MR, or CT, we stop. If there is a question, we proceed to angiography, but only in the appropriate setting. It is not appropriate to attempt to create an environment whereby one can obtain the training necessary to proceed to performing carotid stenting by performing angiography on all comers.

CONTRAST USE

We primarily use bi-plane angiography rather than single-plane angiography for our cerebral angiography, and we are therefore able to reduce the number of injections by 50% by obtaining two views for each injection. There is absolutely no support for performing cerebral angiography using only 50% contrast material mixed with saline. This method may be acceptable in the carotid arteries, but it certainly will not be good enough for viewing small-vessel disease in the head. We use only Omnipaque 300 (GE Healthcare, England).

TRAINING AND CREDENTIALING STANDARDS

We perform 1,100 cerebral angiograms each year in my department at Johns Hopkins. As previously stated, our complication rate is less than 1%, but it is well known that for interventionists who do few, if any, cerebral angiography procedures, the complication rates are far higher, perhaps as high as 8% to 10%.

> "Angiographic evaluations, if performed by individuals who do not possess the necessary experience, have the potential to invite substantial malpractice lawsuits."

The same standards should be in place for both the heart and the head, yet somehow it seems to be acceptable to have completely different standards for education and skill development. How can it possibly take 300 diagnostic coronary interventions to be equipped to proceed to doing diagnostic coronary angiography or intervention, but only 15 to 30 diagnostic cerebral angiograms to accomplish the same level of proficiency? It is not the same skill set, and the brain is not as forgiving as the heart. We must adopt the same system of complications reporting and required skill levels that have been established for coronary artery bypass surgery in New York State. This information must be available locally to every patient, giving each the opportunity to more fully understand the risks they are taking when they sign an informed consent form.

The standards proposed by the ACC are in my opinion grossly inadequate, and the gulf between those standards and those of the neuroscience coalition could ultimately result in two classes of patient treatment. In other words, if these standards are accepted and installed, there will be a significant difference in the care of a patient who receives care based on the ACC guidelines as opposed to care based on the Neuroscience Coalition guidelines. This is not to say that vascular surgeons and cardiologists cannot adequately perform carotid artery stenting; I believe that superb care can be provided by interventionists from every endovascular specialty. The key is that the physician, regardless of specialty, must receive the aforementioned required training and achieve the level of excellence required to perform these procedures.

I believe the patient must be equally safe in all hands, no matter what medical tribe the physician came from. "The patient doesn't care who treats him, he just wants that person to be well trained."—William Osler, 1898 ■

Kieran P. Murphy, MD, is Director, Interventional Neuroradiology at Johns Hopkins, Department of Radiology, Baltimore, Maryland. Dr. Murphy may be reached at (410) 955-8525; kmurphy@jhmi.edu.