Cerebrovascular surgery: evolution or obsolescence

To the Editor: The March 2009 issue of Journal of Neurosurgery contained multiple articles on vascular disease, including many on interventional techniques. Moreover, the present issue contains another important historical article by Prof. Guglielmi. Our observations are as follows.

Over the past years, we have witnessed a radical shift in the treatment modalities for what was once only the domain of neurosurgeons treating neurovascular disease. Prospective data in multicenter trials such as the International Subarachnoid Aneurysm Trial and the International Study of Unruptured Intracranial Aneurysms has shown convincingly that there is an increasing and, in most cases, primary role for endovascular approaches for both ruptured and unruptured aneurysms. 28, 36 Similarly, prospective registries and prospective trials such as the Stenting and Angioplasty with Protection in Patients at High Risk for Endarterectomy trial have demonstrated the superiority for carotid artery (CA) stenting in high-risk patient subgroups, such as those with contralateral occlusion, high CA bifurcations, radiation-induced stenosis, and recurrent stenosis. 2, 3, 7, 12, 13, 16, 22, 25, 35, 37, 38 Although some trials have failed to show convincing evidence in support of stenting (Stent-supported Percutaneous Angioplasty of the Carotid artery versus Endarterectomy, 29 Endarterectomy Versus Angioplasty in Patients with Symptomatic Severe Carotid Stenosis), patient choice, medical disciplines (such as interventional cardiology), and industry will continue to drive CA stenting on the basis of current evidence and potential future evidence from the Carotid Revascularization Endarterectomy versus Stent Trial. 15, 17, 30 It is likely that with improving technology and outcomes in ongoing and future trials that endovascular strategies will assume preeminent roles in CA revascularization.

In addition to disorders typically treated by neurovascular surgeons, many disease states that were previously relegated to medical management as the sole therapeutic option are now amenable to interventional treatments. The Warfarin-Aspirin Symptomatic Intracranial Disease trial demonstrated that, despite optimal medical therapy, symptomatic intracranial stenoses had a high rate of recurrent stroke. 3 This has resulted in reinvigoration of endovascular strategies for revascularization of intracranial stenoses. 5, 9, 11, 14, 21, 23, 24, 26 There are an increasing number of devices specifically designed to meet the challenges of an inhospitable intracranial vasculature and that may be useful for the treatment of intracranial stenoses. The Stenting versus Aggressive Medical Management for Preventing Recurrent Stroke in Intracranial Stenosis and Vitesse Intracranial Stent Study for Ischemic Therapy trials are underway to explore the role for angioplasty and stenting as opposed to optimal medical therapy for this malady.

The extracranial-intracranial bypass trial’s single-handedly virtually eliminated the application of microsurgical strategies for cerebrovascular atherosclerotic occlusive disease. As the intracranial stenting trials are completed and others initiated, the already limited role for extracranial-intracranial bypass being evaluated by the Carotid Occlusion Surgery Study will be further reduced.

Perhaps our largest potential impact as clinicians treating neurovascular disease involves the treatment of patients with acute intracranial occlusive disease. Patients with newly diagnosed stroke and transient ischemic attacks number ~ 795,000 annually. 25 It is estimated that the disease in as many as 200,000 or more individuals in the US alone may be amenable to neurointerventional stroke therapies, including catheter-based mechanical and/or pharmacological interventions. 1, 10, 19, 20, 30, 34 There is a feverish pace to the discussions of a trial design that will once and for all prove the effectiveness of intracranial revascularization for large-vessel occlusion. A small number of such trials are already underway in Europe. Speaking from experience derived over the course of more than a decade, we have found that careful patient selection through identification of salvageable penumbra, using CT perfusion imaging and other strategies, as well as successful revascularization of large-vessel occlusion, results in irrefutable marked improvement in outcome. Therefore, it is our supposition that within the coming decade we will have Level 1 evidence proving the effectiveness of intracranial revascularization strategies. The sheer volume of potential cases that will be amenable to such strategies may exceed the current volume of all neurovascular interventions performed by neurosurgeons and endovascular neurointerventionalists combined manifolds. This will pose an existential risk to currently practiced cerebrovascular treatment strategies. The complexity of navigating tortuous and delicate neurovasculature in the setting of acute occlusion without clear visualization of distal vasculature and within the time constraints of inconvenient emergency intervention, will inherently result in the awareness in all who perform acute intracranial revascularization for stroke that all other neurointerventions currently performed under relatively elective and controlled conditions may be easier or no harder to perform than acute stroke revascularization. The subsequent practice patterns that will emerge remain hard to predict but easy to contemplate.

The remainder of neurovascular diseases such as arteriovenous fistulas, arteriovenous malformations (AVM), vessel sacrifice (for oncologic disorders), symptomatic dissections, nasal epistaxis, and treatment of vasospasm include other disease states amenable to neurointerventional techniques. 5, 9, 18, 30, 32 The microsurgical management of these conditions, except AVMs, remains limited.

Consider the following assertions: 1) The greatest increase in applicants to neurointerventional fellowship programs is by neurologists. 2) Interventional cardio-
gists and peripheral interventionalists are currently treating patients with acute or subacute ischemic disease. If hospitals and medical communities perceive a need for patient care, this role will be filled by physicians trained to provide this needed care, irrespective of their subspecialty.

As neurovascular surgeons, we face an immediate and grave risk of obsolescence if we choose to ignore these trends and pressures on our subspecialty. We face obsolescence because the volume of aneurysm surgery continues to decline (although it will always have a role), AVM resection is 1 modality for the treatment of a not-so-common problem, and the most robust population of patients with neurovascular problems (those with intracranial ischemia) will be treated mostly by intracranial interventional techniques potentially performed by nonneurosurgeons. Surgical revascularization likely will continue to play a shrinking role in the treatment of these patients, as new technologies will surely compete with this surgical option as well. We can mimic the ostrich and bury our heads in the sand, or we can choose to evolve our current way of training our neurosurgeons of the future. We can choose to let stroke be treated by other disciplines such as interventional neurologists and cardiologists who claim to have significant interest in this field and then find ourselves continuing to lose the “market share” of neurovascular disease states. Like it or not, this is an existential issue. Will there always be a role for something open in neurovascular disease? Of course! But it will be a decreasing, limited, circumscribed one that will remove us from the primacy we have enjoyed for the entire history of neurovascular intervention. Is this a turf battle? Absolutely not! Neurosurgeons are without question the best prepared to deal with the neurovasculature and all its interventions. They are trained proceduralists who understand the brain, its physiology, its functioning, its anatomy inside and outside the blood vessels, and the evaluation of the neurological patient; the diagnostic workup, including all radiological studies, is routinely primarily interpreted by the neurosurgeon with additional input from the neuroradiologist. The critical care of a neurosurgical patient, management of the intracranial pressure, the cerebral perfusion pressure, and optimal oxygenation all are part not merely of 6 months or 1 year of training but 6–7 years of neurosurgical residency. We are used to performing procedures in very delicate tissue, and, therefore, the haptics that are required for endovascular training will come easier to us than to a nonsurgeon.

Thus, the argument we make is that there are undoubtedly multiple pathways to gain competency in endovascular neurointervention. All should require a dedicated period to learn the nuances of the neurovasculature, as well as the evaluation, diagnosis, intervention, and subsequent management of the neurological patient. We can make immediate efforts to train our residents to undertake angiography and neurointervention. Throughout the 6 or 7 years of residency, it is quite likely that with the right structure, residents can easily complete more than the minimum 100 angiograms and gain proficiency, as well as learn the basic skill set for neurointervention, just as they learn the basic skill set for clipping aneurysms or doing spinal instrumentation. This basic skill set would not eliminate advanced fellowship training to develop competency in complex neurointerventional techniques; however, it would be similar in scope to open vascular fellowship training to develop the skills needed for performing surgery on complex aneurysms and skull base lesions, or a spine fellowship to perform complex stabilization procedures. Neurovascular surgeons should not be considered “dual trained” but, rather, fully trained in the complete management of neurovascular disease. Changing the way we train our future neurosurgeons would avoid the difficult dilemma of doing interventional fellowships midcareer to remain relevant and clinically active in the neurovascular space.

In summary, our community of vascular neurosurgeons is faced with this quandary: evolve or face obsolescence. If we do not resolve this dilemma, it will be resolved for us over the next several years. (DOI: 10.3171/2009.2.JNS09330)

References


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