Vascular neurosurgery since the International Subarachnoid Aneurysm Trial

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The article by Crocker and colleagues is an interesting and carefully written paper describing the experience of one vascular neurosurgeon in the “post–International Subarachnoid Aneurysm Trial (ISAT) era” in the United Kingdom. Some comments are in order to bring this paper into a more general perspective and specifically a US perspective.

First of all, I find it interesting that the authors believe, and clearly they are not alone in this perception, that the ISAT study defined an “era” in vascular neurosurgery. I think this is interesting because the ISAT study results apply only to a relatively small group of patients; namely, patients in good grade with a ruptured aneurysm of the anterior cerebral artery or the internal carotid artery regions, whose aneurysm was believed by the treating clinician to be amenable both to endovascular therapy and to open microsurgical therapy, and the clinicians were not sure whether one or the other form of therapy was better. This is hardly a universe by which to define an era. Nevertheless, it is unquestionable that this excellent study has influenced vascular practice very significantly. However, a careful reading of this article indicates that in fact, at least at the authors’ institution, the trend toward endovascular surgery in the treatment of aneurysms preceded the ISAT study. During the post–ISAT era that the authors analyzed carefully, they treated 86.6% of ruptured aneurysms endovascularly, whereas, in fact, 92% of aneurysms in this unit were treated endovascularly during the 12 months preceding the ISAT publication. Could it be that the trend toward endovascular surgery for the treatment of ruptured aneurysms has been fueled mostly by the progressive technological developments in this area and the gradual realization that indeed endovascular treatment is quite safe and effective rather than being mostly a result of the influence of ISAT?

The authors rightly have not extrapolated the results of the ISAT study to the treatment of unruptured aneurysms, and although they still seem to show a preference for endovascular treatment whenever possible even for unruptured aneurysms, they do recognize that surgery is quite safe and effective in this setting. In fact they treated, with excellent results, almost half of their elective aneurysms with open microsurgery rather than endovascular therapy. I suspect that the proportion of unruptured aneurysms that are currently treated by open microsurgery in the US is probably larger than this, but unfortunately I do not have solid data in this respect. At our institution, unruptured aneurysms are still preferentially treated using open surgery, except for those aneurysms located in regions such as the basilar artery and frequently the superior hypophysial region where open surgery presents specific difficulties not encountered with endovascular surgery. Clearly, the circumstances that make open surgery less appealing in the case of ruptured aneurysms such as the possibility of an angry swollen brain, early re-rupture of the aneurysm during exposure, and so on, are not operative when the aneurysm is unruptured or when the treatment of the ruptured aneurysm is delayed as it used to be the usual case some 20 years ago. The goal of treatment in an unruptured aneurysm is not to prevent early rebleeding, which we know endovascular therapy is very effective in achieving, but rather to cure the aneurysm permanently and prevent future hemorrhage, which we know open microsurgery achieves very effectively. Only time will tell whether endovascular therapy is as effective. Clearly, given the endovascular alternative that can be achieved usually with low immediate morbidity, the “bar” for safety of open microsurgery for unruptured aneurysms has been raised substantially, and it would be preferable for such surgery to be performed mostly by experienced neurosurgeons in a center with a relatively high volume of these cases; otherwise, the immediate results will not be competitive with those that can be achieved with endovascular therapy.

I am disappointed to see that, for reasons that are not clearly explained, the authors have adopted a bias against open microsurgery for cerebral arteriovenous malformations (AVMs). Although reasonable evidence, including that provided by the ISAT, supports endovascular therapy at least for many ruptured aneurysms, there is no such data, as far as I am aware, supporting a shift toward non-surgical therapy for AVMs. Of 66 interventions for AVMs during the study period, there were only 6 open surgical procedures in their unit. Most of the patients were treated with palliative embolization, frequently with multiple sessions, and yet complete occlusion was achieved in only 16 of these AVMs. The rest were observed or treated with repeated sessions of embolizations or were referred for radiosurgery (8 cases) or for open surgery (only 6 cases). This means that most of the patients with AVMs remain at risk for hemorrhage, and we know that such risk is not diminished by embolization for as long as the AVM remains patent. Granted, the authors experienced very low morbidity rates with embolization, but they should not ig-
more the reported morbidity rates of somewhere between 5 and 11% for embolization of AVMs in several centers with large experience and expertise in endovascular therapy. The authors make the statement: “Our declining practice in AVM surgery reflects a growing trend toward embolization or radiosurgery for such patients.” They are probably correct in presuming that this trend exists. However, is this trend justified and based on reasonable evidence? If there is such evidence I am unaware of it. They further go on to make a statement and a prediction that I believe is unfounded: “The decline in open surgery for AVM has been reflected worldwide and is likely to be formalized by the forthcoming ARUBA…study.” We certainly would not be performing such a study, and the study would not have been funded, if there had been the kind of evidence required to make a prediction that the study will “formalize” a declining role for microsurgery in the treatment of cerebral AVMs.

The final area of vascular surgical experience that the authors comment about briefly is the excimer laser–assisted nonocclusive anastomosis technique for bypasses. Unfortunately, 4 of the 5 bypasses performed in their unit during this period occluded, with a fatal consequence in 1 patient. I suspect that this simply reflects a steep learning curve with this procedure, which, in my opinion, with continuing experience and refinements, will find a place in our neurosurgical armamentarium.

Finally, a very minor point, I noticed that the authors refer, at least on one occasion, to endovascular therapy as “radiological” treatment and to endovascular interventionists as “endovascular radiologists.” They also imply, I believe incorrectly, at least in this country, that it is only exceptionally that endovascular therapy be performed by neurosurgeons. This may be true in Europe, but again without specific numbers, I suspect there is a growing trend in the US for endovascular therapy to be performed by neurosurgeons who are well trained in this field and indeed, as noted by the authors, several of these neurosurgeons are adept and well trained both in endovascular procedures as well as in open microsurgical procedures. I also understand that in Japan most endovascular therapy is performed by neurosurgeons. Although we owe a great debt to our colleagues in neuroradiology but also with an understanding that in Japan most endovascular therapy is performed by neurosurgeons who are well trained in this field and indeed, as noted by the authors, several of these neurosurgeons are adept and well trained both in endovascular procedures as well as in open microsurgical procedures.

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References

Response
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We would like to thank Dr. Heros for the very thoughtful comments on our paper and his invaluable perspective on our work. We are in complete agreement with regard to the management of intracerebral aneurysms and in particular with his approach to unruptured aneurysms. Our aim in publishing these results was to demonstrate that the “post-ISAT” work of dedicated vascular neurosurgeons in large, high-volume institutions, with the full array of endovascular techniques available, has actually increased rather than decreased, as had been consistently predicted. Subspecialization has resulted in a more uniform, multidisciplinary approach to these complex lesions with ultimately better outcomes for our patients. We also agree, and our practice reflects this, that unruptured aneurysms should preferentially be treated by surgical clipping along the lines described by Dr. Heros’ editorial.

We need, however, to clarify our management of AVMs, which, from Dr. Heros’ interpretation of our results, appears that we routinely partially embolize, leaving a large number of patients at risk. All AVMs that have been evaluated at our institution are reviewed in our joint neurovascular clinic and the decision to treat is based on a variety of factors, mainly clinical picture, Spetzler–Martin grade, age, comorbidity, and presence of aneurysms. Our aim is always complete obliteration. Our very experienced neuroradiologists will attempt embolization and only proceed if they are confident they will achieve it. If complete occlusion is not achieved, the patient is referred for excision and/or stereotactic radiosurgery. Moreover, when a partial occlusion is anticipated, a combined approach is undertaken, and the patient is moved to the operating room after partial embolization to complete the excision. These approaches are routinely applied to most Grade I–III AVMs. For the higher-grade lesions, as is the practice of most large institutions, our approach is more conservative. We would like to refer the reader to the following section of our article:

Recent Endovascular Treatment of Intracranial AVMs
Sixty-six embolization procedures were performed to treat cerebral AVMs in 39 different patients, 19 of whom presented with hemorrhage. All procedures were performed with curative intent, and in cases in which embolization failed to achieve complete occlusion further treatment aimed at occlusion was planned. Complete occlusion was successful in 16 patients after the first attempt, 5 achieved complete occlusion after multiple endovascular procedures, 8 were referred for stereotactic radiosurgery, 6 were referred for open surgery, 3 are still under review, and 1 was lost to follow-up.
The 3 patients who did not undergo complete occlusion will undergo further sessions, and we actively monitor patients who underwent stereotactic radiosurgery. Moreover, the senior author’s (C.M.T.) practice is to offer patients repeated MR imaging up to 5 five years after complete occlusion by embolization to eliminate the slight theoretical risk of recurrence. We therefore believe that we have not adopted “a bias against open microsurgery for cerebral AVMs,” but rather that our practice reflects a true multidisciplinary approach to these lesions.

Finally, with regard to the excimer laser–assisted nonocclusive anastomosis technique, we agree with Dr. Heros that we are on a steep learning curve, but it is also important to stress that 2 of our bypasses were prophylactic, competitive ones, which assisted in the clipping of complex cerebral aneurysms and were allowed to thrombose when the primary aim was achieved.

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