Editorial

Middle cerebral artery aneurysms

MICHAEL T. LAWTON, M.D.

Department of Neurological Surgery, University of California, San Francisco, California

The International Subarachnoid Aneurysm Trial (ISAT) changed the management of brain aneurysms worldwide, legitimizing endovascular coiling as a safe alternative to surgical clipping and supplanting clipping as the treatment of choice for many aneurysms at many centers. The Barrow Ruptured Aneurysm Trial (BRAT) reinforced many of the results from ISAT and eliminated the criticism that American surgeons with more aneurysm experience would have better microsurgical results. One response to these randomized trials has been the adoption of a “coil first” policy whereby all or most aneurysms be considered for coiling, reserving surgery for those lesions with unfavorable anatomy or failed coiling attempts.

This experience described by Johnson et al. with stent-assisted embolization of 100 middle cerebral artery aneurysms is an example of an aggressive endovascular posture toward an aneurysm long considered unfavorable for coiling based on the lesion’s trifurcated anatomy, broad necks, dysmorphic shapes, and angiographically undecipherable branches. The authors demonstrate that stents enable reconstruction of wide-necked and fusiform MCA aneurysms that were not well treated by simple coiling, thereby broadening the range of aneurysms accessible to the neurointerventionalist. At Rush University Medical Center, 75% of unruptured and 65% of ruptured MCA aneurysms are embolized. Although the complete aneurysm occlusion rate was initially only 42%, it increased to 90.6% at 6 months, with associated rates of major morbidity and mortality of 1% and 1%, respectively. I congratulate the authors on this achievement. However, the fine details must be carefully scrutinized. Transient neurological deficits were observed in 5% and minor permanent deficits in 2%. Late complications included transient ischemic events in 4.1%, intracerebral hemorrhage related to antiplatelet therapy in 1%, in-stent stenosis in 9.4%, stent-related arterial occlusion in 1.2%, and groin complications in 3%. With respect to the aneurysm, 9.4% were incompletely occluded and 4.7% required retreatment. These fine details show that as stents are applied, the procedural risks and side effects begin to mount.

This study deserves some criticism for its case selection, short follow-up, and lack of angiographic surveillance beyond 6 months. Although indications included wide necks, low dome-to-neck ratios, and fusiform morphology, these aneurysms were, from an operative perspective, not complex: 85% were less than 10 mm in diameter; only 3 were giant in size; and only 5 were acutely ruptured. Therefore, these 100 lesions were a favorable lot. The mean length of clinical follow-up was under 2 years, which, as we learned from ISAT, is within the time window when endovascular advantages in safety are evident but problems associated with efficacy, durability, rehemorrhage, recurrence, and retreatment have not surfaced yet. Indeed, it took 5 years for outcome advantages associated with coiling in ISAT to vanish, which means that additional follow-up is needed with this current study.1 Methodologically, follow-up images beyond 1 year were only obtained in 48 patients and consisted of MR angiography (MRA), not catheter angiography. Magnetic resonance angiography is notorious for overestimating aneurysm obliteration, particularly with imaging artifact from stents and coils. This surveillance needs to be longer, more complete, and more definitive before we can conclude that stent-assisted embolization has favorably impacted the natural history of MCA aneurysms.

Aneurysms of the MCA have long been considered favorable for clipping because they are accessible, can be easily manipulated after splitting the sylvian fissure, and are amenable to other treatment techniques like thrombectomy, clip reconstruction, and bypass when conventional clipping techniques fail. The MCA aneurysm is the best example of an aneurysm whose microsurgical results are widely regarded as superior to endovascular results. In contrast to the Rush University approach, I manage MCA aneurysms with an aggressive surgical posture. Patients are informed of all surgical, endovascular, and conservative options and have the freedom to choose their therapy, but patients on the Vascular Neurosurgery service are given a recommendation for surgery. With this traditional “clip first” policy for MCA aneurysms at the University of California, San Francisco, 543 patients (89%) were treated surgically and 64 patients (11%) were treated endovascularly during a 13-year period.6 One hundred fifteen surgical patients (21%) were referred from the Neurointerventional Radiology group, reflecting a mutual surgical preference.

Our experience with 631 MCA aneurysms in these 543 patients demonstrated that microsurgery continues to yield excellent results with a wide spectrum of patients and lesions that included giant (5%), thrombotic (8%),
and dolichoectatic (5%) aneurysms, ruptured aneurysms in poor-grade patients (11%), and aneurysms in older patients (> 65 year [24%]); 95% were clipped directly and 4% required bypass and trapping. Complete aneurysm obliteration was achieved in 98.3% (620 of 631), and 284 other aneurysms were clipped simultaneously. Surgical complications occurred in 31 patients, of whom 7 had permanent morbidity. The overall morbidity and mortality rates were 4.6% and 5.7%, respectively, with ruptured presentation, Hunt and Hess grade, hemicraniectomy, and giant size significantly influencing outcomes. To compare with the stent-assisted embolization results of Johnson et al., morbidity and mortality rates for unruptured aneurysms are more appropriate and were 5.4% and 1.5%, respectively. There were no rehemorrhages or retreatments, and late angiographic follow-up (mean duration 3.9 years) in 106 patients found no aneurysm recurrences.

As Johnson et al. state, “direct comparison of endovascular and open surgical repair is not straightforward.” Endovascular series are highly selected; surgical series are overly inclusive; and even randomized trials have exclusion criteria or crossovers that complicate the analysis. However, from an evidence-based perspective, the preponderance of data still supports microsurgical management of MCA aneurysms because of the capacity to treat all patients and all aneurysms with a variety of techniques, acceptably low morbidity/mortality, proven long-term durability, effective protection from aneurysm rupture, and approaches that are increasing minimally invasive. For now, the MCA aneurysm stands out as an example of how therapeutic management decisions can be made based on aneurysm location alone. Patients are managed best when they are in specialized centers, receive care from dedicated experts, have all treatment options available to them, and are free to make their own choices. Still, they need clear recommendations from their neurosurgeons and other clinicians. Although recommendations or management policies cannot be mandated, consensus supporting surgical clipping of MCA aneurysms is particularly strong and clinicians should feel comfortable speaking with a clear and consistent voice that favors clipping for MCA aneurysms.

At present, the push to use endovascular therapies in MCA aneurysms is driven not by convincing data but by patient preferences, technological evolution, and interventional zeal. Johnson et al. have made an important contribution by demonstrating that stent-assisted embolization may be a better endovascular option for MCA aneurysms than simple coiling, but the requirement of antplatelet agents limits stenting in patients with ruptured aneurysms. Flow diverters like the Pipeline embolization device might improve results, but they work best in the cavernous and paraclinoid carotid artery where the parent artery is large and there are few branch arteries. Pipeline results have been poor in the posterior circulation where there are numerous perforators, and MCA aneurysms are similarly associated with multiple branches and lenticulostriate perforators. Novel endovascular devices and technical advancements will inevitably challenge the clip-first approach with MCA aneurysms. Patients’ desire to avoid craniotomy is a powerful market force that industry is heeding. As we develop and evaluate new technology, we must establish that endovascular results match surgical benchmarks before they are considered acceptable alternatives to surgery.

Disclosure

The author reports no conflict of interest.

References


Response

DEMETRIUS K. LOPES, M.D., ANDREW K. JOHNSON, M.D., AND DANIEL M. HEIFERMAN

Department of Neurosurgery, Rush University Medical Center, Chicago, Illinois

We would like to thank Dr. Lawton for his insightful comments and perspective regarding MCA aneurysm treatment. Dr. Lawton shares his outstanding results treating aneurysms at this location surgically, contending that our series of MCA aneurysms managed with stent-assisted coiling has significant selection bias. Indeed, historical surgical series were all inclusive and endovascular series are highly selected. Clipping has been the standard of care, and it is appropriate for the newer therapy to make small steps toward the eventual optimal balance in treatment paradigm that the neurovascular community strives to attain. We expect that the progress of endovascular treatment has also introduced a beneficial selection bias to Dr. Lawton’s aneurysm clipping series, improving the overall results for his patients.

We acknowledge the nonneurological morbidity as-
sociated with endovascular aneurysm repair, but we con-
tend that this morbidity and the overall patient discomfort
and inconvenience are not worse than those associated
with craniotomy.

Dr. Lawton states that MRA “is notorious for over-
estimating aneurysm obliteration, particularly with im-
ing artifact from stents and coils.” Contrast-enhanced
MRA can overcome these artifact limitations. Contrast-
enhanced MRA has been quite accurate in our experi-
ence; it actually overestimated the residual aneurysm in
several cases in our overall stent-assisted coil experience,
confirmed by subsequent digital subtraction angiography.

The verdict on stent-assisted coiling for long-term
aneurysm obliteration is pending, but studies indicate a
trend toward progressive aneurysm thrombosis and de-
creased recurrence when stents are used compared to coil
embolization alone. Complete aneurysm occlusion may
not always be necessary after stent reconstruction. Our
overall stent-assisted embolization results have shown an-
eurysm recurrence after a stable follow-up angiogram in
only 3 of 257 aneurysms followed for over 1 year; each of
these 3 aneurysms was greater than 20 mm in diameter.

Aneurysm-treating teams are diverse in their areas of
expertise and experience. Aneurysm clipping has evolved
over 5 decades, and Dr. Lawton has delivered outstanding
results to his very large cohort of MCA aneurysm
patients. We hope that our results in this first decade of
stent-assisted aneurysm embolization will help endovas-
cular aneurysm repair strategies evolve. More sophisti-
cated devices and antiplatelet management should refine
treatment and improve results in the future. We appre-
ciate Dr. Lawton’s response, and these ongoing debates
should help our community make aneurysm treatment an
increasingly accurate and safe endeavor.

Disclosure

Dr. Lopes is a consultant for Stryker.

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