Management of Unruptured Intracranial Aneurysms
Perspectives on Endosaccular Coiling and Persistent Uncertainties

David G. Piepgras, MD; Robert D. Brown Jr, MD, MPH

See related article, pages 899–904.

In the retrospective analysis of their experience in treating 173 patients with 202 unruptured intracranial aneurysms (UIAs) with endosaccular coiling over a 12 year span from 1992 through August 2004, Standhardt et al\(^1\) document treatment outcomes with low morbidity and mortality but highly variable efficacy relative to durable, complete aneurysm obliteration. Such has been the experience of other investigators.\(^2\) Although the reported data are of interest, numerous questions remain, including the comprehensive postprocedure assessment of morbidity and mortality, and risk of adverse outcomes compared to natural history.

In this series 48% of the aneurysms were incidentally discovered, and approximately 30% were “other” aneurysms in patients having experienced hemorrhage from another aneurysm, so-called Group II patients in the International Study of Unruptured Intracranial Aneurysms (ISUIA),\(^3\) and 14% were symptomatic due to mass effect (typically larger aneurysms). Nearly 44% of these aneurysms were small in size (<7 mm diameter), 37% of medium size (7 to 12 mm) and nearly 20% large to giant in dimension. About half of the aneurysms had a small neck (<4 mm in breadth) which is commonly regarded as optimal for endosaccular coiling assuming no complicating anatomy such as branches arising from the aneurysm base or conditions such as existence of intraluminal thrombus.

Relative to procedural risk, particularly as compared to those of craniotomy and aneurysm clipping, the results which these operators have achieved are excellent—mortality in 0.5% and permanent stroke morbidity in 3.5%, with only 1% ultimately sustaining permanent severe deficit. Furthermore, the major complications occurred in the early years of the study with no major morbidity or mortality in the last 5 years, undoubtedly related to improvement in technology and techniques. Given the relatively small number of cases, management risks with regard to aneurysm site, size and age could not be delineated. This is of importance given the suggestion that these factors may have a marked impact on the risk of a procedure,\(^3\) although perhaps less so for coiling. It is also particularly important to note that the outcomes were determined in a retrospective manner, primarily via chart review.

The amount of detail available in the medical record, and nature of neurological follow-up after intervention is not clear. It is recognized that major disabling adverse events would likely be defined via retrospective chart review, but less severe adverse events may be poorly characterized. Data from ISUIA suggest that cognitive outcomes may be an important contributor to the overall outcomes after treatment, but those data were not available in the present study.\(^3\) Additionally, assessments of neurological status other than modified Rankin Scale were understandably not available in this retrospective review.

From the perspective of aneurysm elimination, the results achieved with initial coiling are less impressive with complete obliteration of the aneurysm accomplished in 72% of small aneurysms, 59% of medium sized aneurysms, 35% of large aneurysms and 11% of giant aneurysms. Neck remnants aside, incomplete aneurysm obliteration ranged from 10% in small aneurysms to 32% in giant aneurysms. Recanalization of the aneurysm sac on routine follow-up angiography at 6 to 12 months was documented in some of the small and medium aneurysms and in the majority of large and giant aneurysms, necessitating additional treatments.

Among aneurysm experts, conventional wisdom (based primarily on treatment of ruptured aneurysms) has held that incompletely treated aneurysms carry significant early as well as long-term risk for rehemorrhage. The reality is that endosaccular coiling, unlike clipping, does not directly close the aneurysm neck and that partial aneurysm recanalization after endosaccular coiling is relatively common, and has led to strong concerns—especially among aneurysm microsurgeons—as to the long-term efficacy of coiling treatment. Information from multicenter trials indicates that for smaller aneurysms, the risk of repeat hemorrhage is low. Recurrent hemorrhage after 1 year in ISAT was 0.2% per patient-year for patients treated with endosaccular coiling and very much lower for those treated with clipping.\(^4\) An observational study, CARAT, showed similar findings with an annual rate for rerupture after the first year being 0.11% for coiling and 0% for clipping.\(^5\)

Such long-term data for treatment of UIAs is unavailable\(^6\) but seems especially important given the fact that hemorrhage risk for small UIAs is low. ISUIA data suggested a long-term risk of hemorrhage that was dependent on aneurysm site and size, and overall showed a risk of hemorrhage in smaller aneurysms of <1% per year, even in the highest risk locations (posterior communicating artery and posterior circulation) and the subgroup with previous subarachnoid hemorrhage from another aneurysm.\(^3\) Ongoing analysis of ISUIA patients treated with either endosaccular coiling or aneurysm clipping has documented overall hemorrhage rates in the first 5 years...
after treatment of an UIA (inclusive of all aneurysm sizes and locations) to be 0.7% per year for endovascular coiling and 0.2% per year for clipping, the risk being highest in the first 30 days post-treatment and for larger aneurysms (>15 mm).

In this context the findings of Standhardt et al are particularly relevant—follow-up was available in 95% of the aneurysms and in excess of 5 years in 32% of the cases. However, the mean follow-up was only approximately 3 years. It is noteworthy that the only hemorrhages occurred in giant aneurysms of the vertebrobasilar circulation (3 of 8 cases) with an annual rupture risk of 11.5% per year, which is not significantly different than the natural history of these aneurysms as identified in the ISUIA. This finding in itself should incline aneurysm interventionalists and surgeons to strongly consider and counsel patients regarding alternative aneurysm treatment such as clipping in these special cases, while recognizing as well the higher risk that accompanies such treatments.

Interestingly in their series, Standhardt and colleagues found no late hemorrhages in the treated giant aneurysms of the anterior circulation or the larger aneurysms which carried higher rates of incomplete treatment. The importance of additional treatments and the need for ongoing follow-up of these particular lesions warrants emphasis.

In the final analysis, the authors and management team are to be commended for the treatment results they have achieved and careful analysis of their patient population. Important questions remain unanswered such as which UIAs will benefit from interventional management, and which treatment would be best for which aneurysm. The existing studies and experience have provided clinicians with an understanding of certain aneurysm characteristics which direct the management for a specific unruptured aneurysm as well as best technique for repair, while considering treatment risks and efficacy. Nevertheless, there exists a large population of patients with UIAs—lesions that are so commonly found in the general population and in clinical practice—for which we do not have answers to best management, whether that be observational management with control of potential hemorrhage risk factors and repeat imaging at regular intervals, endovascular intervention, or craniotomy and clipping. Does interventional management with coiling reduce risk of hemorrhage in a group of aneurysms of diverse size and site characteristics? That is uncertain, and to best answer this question, a randomized clinical trial seems warranted.

Disclosures
D.G.P. is co-investigator for Neurosurgery. R.D.B. is principal investigator for Neurosurgery. The authors are investigators for the International Study of Unruptured Intracranial Aneurysms (ISUIA), an NIH sponsored multicenter study.

References

KEY WORDS: endovascular treatment intracranial aneurysm
Management of Unruptured Intracranial Aneurysms: Perspectives on Endosaccular Coiling and Persistent Uncertainties
David G. Piepgras and Robert D. Brown, Jr

*Stroke*. 2008;39:743-744; originally published online February 7, 2008; doi: 10.1161/STROKEAHA.107.501007

*Stroke* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2008 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/39/3/743

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Stroke* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Stroke* is online at:
http://stroke.ahajournals.org//subscriptions/