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Aneurysm

The combined approach to intracranial aneurysm treatment

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Abstract

Background: A consecutive series of patients with intracranial aneurysms in the practice of one neurovascular surgeon was retrospectively reviewed to illustrate that one physician can become proficient in microneurosurgery as well as endovascular surgery and achieve favorable outcomes in both disciplines. This supports one model of training for cerebrovascular surgeons that includes the complimentary practice of open microneurovascular surgery with endovascular surgery.

Methods: The senior author (HAR) treated 351 patients with 413 aneurysms between July 2001 and March 2007. Of these, 172 patients (216 aneurysms) were treated with open microneurosurgical techniques and 179 patients (197 aneurysms) were treated using endovascular techniques.

Results: Complete obliteration was attained in 94.3% of clipped aneurysms, and 61.9% and 65.9% of coiled aneurysms immediately and after at least 6 months of follow-up, respectively. At latest evaluation, 93% of endovascular patients and 90% of microneurosurgical patients had good clinical outcomes (GOS, 4 or 5; mean follow-up, 23 months; combines ruptured and unruptured cohorts). Procedure-related mortality included 1 surgical patient and 2 endovascular patients.

Conclusions: Because the fields of microvascular and endovascular surgeries are both technically complex, there has been concern that hybrid cerebrovascular surgeons cannot perform each technique with the skill necessary to achieve good outcomes. When compared to clipping and coiling reviews in the neurosurgical literature, we illustrate that one hybrid neurovascular surgeon is capable of attaining great facility in both techniques and that this type of physician will represent one practice model of cerebrovascular specialist in the future. This has potential implications for the training of hybrid cerebrovascular surgeons.

Keywords: Endovascular; Intracranial aneurysm surgery; Aneurysm clipping; Aneurysm coiling

1. Background

Cerebrovascular neurosurgery has evolved over the last few generations of neurologic surgeons. Recent innovations in endovascular technology, including enhanced coil construction, intracranial stents, balloon remodeling, and the 2-catheter technique, have led to rapid advances in minimally invasive aneurysm treatment [7,28,44,64,67]. It is currently possible to treat even complex intracranial aneurysms both surgically and endovascularly using a wide variety of techniques and devices [39,67]. As current technologies progress, however, endovascular innovation promises to continue its expansion. At the same time, posttreatment outcome assessment and expectations have increased significantly over the past few years, setting new standards for lower morbidity and ultimately improving quality of life for the patient.

Initially viewed with skepticism on its long-term durability, endovascular aneurysm treatment is now an accepted alternative therapy. Following the ISAT, in many centers, particularly outside of the United States, endovascular therapy has become the first-line management for patients with ruptured cerebral aneurysms [36]. Recently, the BRAT found similar results to the ISAT study (American Association of Neurological Surgeons meeting, Chicago, 2008). In reaction to this trend, neurosurgical residents interested in the

Abbreviations: ACA, Anterior Cerebral Artery; BRAT, Barrow Ruptured Aneurysm Trial; DSA, digital subtraction angiography; GOS, Glasgow Outcome Score; ICG, Indocyanine Green; ISAT, International Subarachnoid Aneurysm Trial; ISUIA, International Study of Unruptured Intracranial Aneurysms; NS, Neurological Surgery; SAH, subarachnoid hemorrhage.

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management of cerebrovascular disease are increasingly opting for training opportunities in both microneurosurgery as well as endovascular surgery [20]. Hence, the concept of a cerebrovascular surgeon trained in multimodalities is becoming more prevalent. Versed in both surgical and endovascular techniques, a surgeon trained in the hybrid approach is capable of implementing either option in appropriately selected patients to enhance aneurysm management. Surgeons equipped to provide both approaches propel the field of cerebrovascular aneurysm therapy toward a broader understanding of comprehensive patient care.

The challenge becomes how to train surgeons in dual modalities, although the modalities may require different skill sets. Within a framework of guidance, oversight, and collegial sharing of clinical experience, it is indeed possible to produce cerebrovascular surgeons who are skilled and experienced in both surgical and endovascular techniques. Trainees are under demands to treat a complex disease process using all possible means for success with little room for learning curve trends. In an environment that affords a high enough volume and cross-section of diagnoses, team teaching scenarios with more experienced colleagues are proving to be an effective vehicle for management of the most complex patient cases.

The cerebrovascular surgical data presented herewith is a retrospective review of the initial 5.67 years of practice of one surgeon trained and experienced in both surgical and endovascular techniques. Technical and clinical outcomes of surgically and endovascularly treated patients with both ruptured and unruptured intracranial aneurysms are presented. The objective is to demonstrate that a cerebrovascular surgeon possessing mastery of both techniques is capable of producing excellent clinical outcomes using either option. Although each modality in itself remains an invaluable tool, the data suggest that one successful model of cerebrovascular practice is one where the neurosurgeon provides both treatment options (surgical and endovascular) to patients.

2. Materials and methods

2.1. Patients

Between July 2001 and March 2007, 351 patients harboring 413 intracranial aneurysms treated by the senior author (HAR) at the New York Presbyterian Hospital-Weill Medical College of Cornell University were retrospectively reviewed. These included 172 patients with 216 aneurysms treated surgically and 179 patients with 197 aneurysms treated endovascularly. Thirty-three patients had more than one aneurysm clipped on the same day. Twenty-five patients had 2 aneurysms clipped, 6 patients had 3 aneurysms clipped, 1 patient had 4 aneurysms clipped, and 1 patient had 5 aneurysms clipped. Twelve patients had 2 aneurysms coiled during the same procedure and 3 patients had 3 aneurysms coiled during the same procedure. A combination of both microsurgery and endovascular techniques were used to treat 11 patients.

There were 105 men and 246 women with a mean age of 55.4 years (see Table 1 for demographic characteristics of the patient pool). Most patients presented with SAH (n = 204; Table 2). Of these, 102 proceeded to surgical clipping, whereas 102 proceeded to endovascular coiling. The referral of patients with SAH to the senior author (HAR) was determined solely by the vascular call schedule. There were 147 incidental aneurysms, of which 70 aneurysms were treated surgically and 77 were treated endovascularly.

DSA, or occasionally CT angiography, was used to define aneurysm location and morphology. All patients treated with surgical clipping or endovascular coiling by the senior author, regardless of clinical grade, were included in the study. The decision to proceed to coiling or clipping was made by the senior author in consultation with patients and families and with a view to the technical aspects and clinical risks of each technique. Patients were not randomized to one treatment or

Table 2
Patient Hunt-Hess Grade at Presentation as related to treatment

Admission HH grade	Surgical	Endovascular	Total
0 (unruptured)	48	68	116
I	47	41	
II	8	9	
III	21	20	
IV	11	14	
V	3	3	
Total I-V	90	87	177
Total aneurysms	138	155	293

HH indicates Hunt and Hess.

Table 1
Patient demographics

	Surgical (n = 138)		Endovascular (n = 155)	
	Ruptured	Unruptured	Ruptured	Unruptured
Patients (n = 241)	78	37	82	55
Aneurysms (n = 293)	90	48	87	68
Age (y) (mean ± SD)	39-80 (56.3 ± 1.35)	1-80 (50.7 ± 1.43	14-88 (57.8 ± 1.51)	24-87 (57.6 ± 1.65)
Sex (% female)	62.8	75.6	67.0	74.5
Anterior circulation (%)	96.6	95.8	82.7	85.2
Aneurysm number (range [mean ± SD])	1-3 (1.14 ± 0.04)	1-4 (1.29 ± 0.09)	1-3 (1.06 ± 0.03)	1-4 (1.26 ± 0.08)
Large aneurysm (%)	42.2	45.8	54.0	52.9
Unknown size (n [%])	15 (16.6)	6 (12.5)	2 (2.2)	9 (13.2)