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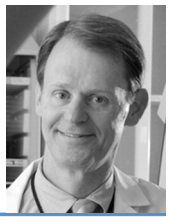

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Endovascular Treatment of Giant Intracranial Aneurysms: A Work in Progress

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Simply stated, there is often no ideal treatment option for giant intracranial aneurysms. Early experience with operative treatment of large and giant aneurysms frequently yielded perioperative complications. In fact, all series including treatment of giant aneurysms reported before 1980 reported a mortality rate in excess of 20% (12, 16, 19, 27, 43) (most of these series included small aneurysms as well). More recent series have reported mortality rates of <10%; however, morbidity rates approximate 30% (3, 7, 8, 11, 13, 14, 18, 23-26, 37, 41, 44, 52). This trend is both encouraging and troubling. It is encouraging that the incidence of complications and mortality after giant aneurysm surgery seems to be on the decline. It is troubling because giant aneurysm represents a high-risk disease with high-risk treatment, with no dramatic change in treatment outcomes in the last 30 years.

In this issue of **WORLD NEUROSURGERY**, Nanda et al. (38) report a 20-year single-surgeon experience with operative treatment of giant aneurysms. This 59-patient sample offers an insight on a heterogeneous population of patients with giant aneurysms. A retrospective analysis of complications and outcomes is presented, with reported morbidity and mortality rates (27% and 10%, respectively) on par with similar reports. An expected correlation with outcome and poor examination on admission and aneurysm location is shown. No analysis of aneurysm obliteration rate is provided. This series serves as a valuable contemporary reference for estimating perioperative risk associated with the treatment of giant aneurysms. This is relevant because endovascular treatment strategies for aneurysms continue to evolve, and past experiences may serve as a measuring stick for new technologies.

It should be noted that although coil embolization has been successful at aneurysm obliteration with improved patient outcomes compared with clip ligation (35, 36), endovascular treatments to date have not yielded a dramatic decline in perioperative morbidity for treatment of giant aneurysms in particular. This is highlighted by Nanda et al. (38) in a review of the literature. Their review shows that perioperative morbidity and mortality of endovascular treatments with detachable coils (with or without stent reconstruction of the aneurysm neck) is not far removed from the risk of open surgical treatment (combined mortality in follow-up was 11% among 122 patients treated by endovascular approaches) (6, 17, 20, 30, 31, 42, 45, 48, 53, 54). However, the strength of most of these reports is limited. Many are small series (6 of 11 comprised <10 patients), and most have a limited follow-up duration. Additionally, many patients in those reports were treated without availability of contemporary detachable coils or intracranial stenting systems.

Our own series (20) of patients with giant aneurysms treated with endovascular techniques between December 2001 and July 2007 offers a mean follow-up in excess of 2 years and stands as among the worst in terms of long-term mortality (at 29%) after endovascular treatment of giant aneurysms. Sadly, the introduction of next-generation intracranial stents and flow-diversion stents has not resulted in a dramatic decline in the incidence of complications after treatment of giant aneurysms. Our single-institution experience since then (between August 2007 and December 2012; mean follow-up ± SD, 9.4 ± 18 months) includes 8 mortalities among 26 patients treated (31%), including 12 patients with perioperative complications and 12 patients with permanent neurological

Key words
- Giant intracranial aneurysm
- Microsurgical management
- Single surgeon

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Table 1. Giant Intracranial Aneurysms Treated by Endovascular Approaches at University at Buffalo Neurosurgery, August 2007 to December 2012

Case	Age (years)	Status at Presentation	Presentation mRS Score	Aneurysm Location	Aneurysm Size (mm)	Procedure Description in Brief	30-Day Complications	Permanent Neurological Morbidity or Death in Follow-Up	Last Follow-Up mRS Score
1*	59	Incidental	0	MCA	33	Stent/coil	No	No	0
2*	65	Rupture	2	ICA	28	Stent/coil	No	No	0
3*	69	Mass effect	2	TOB	26	Stent/coil—waffle cone	No	No	3
4*	62	Ischemic symptoms	2	VBJ	25	Vessel sacrifice	Ischemic stroke, death	Death (4 weeks postprocedure)	6
5*	53	Rupture	5	ICA	25	Stent/coil	No	No	5
6*	34	Ischemic symptoms	1	VBJ	33	Stent/coil—includes covered stents	Ischemic stroke, death	Death (2 days postprocedure)	6
7*	65	Rupture	5	PCA	27	Vessel sacrifice	Death	Death (5 days postprocedure)	6
8†	65	Mass effect	1	ICA	28	Flow diversion	SAH	No	1
9*	84	Ischemic symptoms	3	ICA	27	Stent no coils	Ischemic stroke, death	Death (6 days postprocedure)	6
10	46	Rupture	2	ICA	28	Stent/coil	No	No	2
11	64	Mass effect	1	ICA	26	Stent/coil	No	No	0
12	47	Ischemic symptoms	1	PCA	26	Vessel sacrifice	No	No	1
13‡	45	Ischemic symptoms	2	Basilar artery	35	Flow diversion	Rupture, death	Death (2 days postprocedure)	6
14§	35	Ischemic symptoms	0	MCA	30	Coil and flow diversion	Ischemic stroke	Ischemic stroke—mild permanent deficit	1
15‡	42	Ischemic symptoms	2	Basilar artery	37	Coil and flow diversion	No	Death (8 weeks postprocedure)	6
16§	61	Mass effect	1	ICA	29	Flow diversion	No	No	1
17§	80	Mass effect	1	ICA	25	Flow diversion	No	No	0
18§	83	Ischemic symptoms	2	VBJ	25	Flow diversion	No	Death (6 months postprocedure)	6
19§	58	Mass effect	1	ICA	51	Flow diversion	No	No	0
20	77	Incidental	0	ICA	43	Flow diversion	No	No	0
21	55	Mass effect	1	ICA	31	Flow diversion	TIA	No	0
22	29	Mass effect	1	VBJ	27	Flow diversion	Maldeployment of flow diversion device with subsequent aneurysm rupture	Brainstem infarct —severe permanent deficit	5
23	72	Mass effect	0	TOB	27	Stent/coil	No	No	0
24	66	Mass effect	1	MCA	31	Coil and flow diversion	Ischemic stroke —transient aphasia	Ischemic stroke—mild permanent deficit	1
25	61	Mass effect	2	ICA	25	Flow diversion	Intraparenchymal hemorrhage	Intraparenchymal hemorrhage—severe permanent deficit	5
26	63	Rupture	5	MCA	31	Vessel sacrifice	Death	Death (7 days postprocedure)	6

mRS, modified Rankin Scale; MCA, middle cerebral artery; ICA, internal carotid artery; TOB, top of basilar artery (basilar apex); VBJ, vertebrobasilar junction; PCA, posterior cerebral artery; SAH, subarachnoid hemorrhage; TIA, transient ischemic attack.

*Cases previously reported in Jashan et al. (21); case 1 also reported in Abla et al. (1).

†Case previously reported in Pipeline™ for Uncoilable or Failed Aneurysms (PUFS) trial (4).

‡Cases previously reported in Siddiqui et al. (46).

§Cases previously reported in Kan et al. (22).

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