Middle Cerebral Artery Aneurysms: A Single-Center Series Comparing Endovascular and Surgical Treatment

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Key words
- Cerebral aneurysms
- Endovascular coiling
- Middle cerebral artery
- Surgical clipping

Abbreviations and Acronyms
CI: Confidence interval
ISAT: International Subarachnoid Aneurysm Trial
MCA: Middle cerebral artery
mRS: Modified Rankin scale

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OBJECTIVE: **The optimal treatment for middle cerebral artery (MCA) aneurysms is controversial. MCA aneurysms have been considered more conducive to surgical treatment. Recent technology has led to successful endovascular treatment of MCA aneurysms. The objective of this study was to analyze the outcomes of endovascular and surgical treatment of MCA aneurysms as experienced by a single tertiary center.**

METHODS: **We retrospectively reviewed 90 MCA aneurysms in 84 patients treated from 2005 to 2010. They were separated into 2 groups: endovascular coiling, with 50 (59.5%) patients, and surgical clipping, with 34 (40.5%) patients. Outcome was based on complications, procedural morbidity and mortality, clinical and angiographic outcomes, and retreatment rates. Patients were further separated into ruptured and unruptured aneurysm groups.**

RESULTS: **Ruptured aneurysms were 10 of 50 (20%) and 9 of 34 (26.5%) patients in the endovascular and surgical groups, respectively. Procedure-related complications were 16% and 0% for the endovascular and surgical groups ($P = .01$), respectively. Overall rate of complete or near-complete occlusion at angiographic follow-up was 86% and 95% for the endovascular and surgical groups ($P = .16$), respectively. Proportion of patients with modified Rankin scale of 3 to 6 at 6 months follow-up was 10% and 5.9% for the endovascular and surgical groups ($P = .5$), respectively. The mean angiographic follow-up was 9.02 months (range 0 to 5.2 years). Retreatment rates were 14% and 0% for the endovascular and surgical groups, respectively ($P = .01$).**

CONCLUSIONS: **In this nonrandomized sample of 90 MCA aneurysms treated with endovascular coiling or neurosurgical clipping, we observed a similar clinical outcome based on the modified Rankin scale and angiographic occlusion. Complication and retreatment rates were higher but not significant for the endovascular group. Both treatment modalities are good alternatives and should be individualized based on aneurysm angioarchitecture and the patient's general conditions.**

INTRODUCTION

Aneurysms of the middle cerebral artery (MCA) are primarily treated with surgical clipping in most centers (5, 6, 8, 15, 17, 19). This preference is due to the relatively straightforward surgical approach and unfavorable endovascular access to these aneurysms due to the complex branching pattern of the MCA. MCA bifurcation location is often considered a relative contraindication for endovascular treatment due to the anatomical features of these aneurysms, including a wide neck and incorporation of 1 or more M2 branches into the aneurysm's neck. In general, the superiority of clipping vs coiling in unruptured aneurysms has not been proven by an independent study. After the results of the International Subarachnoid Aneurysm Trial (ISAT) study were published, the tendency toward coiling as first-line treatment has significantly changed the practice pattern of aneurysm treatment, leaving the complex and difficult aneurysms for surgery. Recently, with improvement in interventional techniques (stent and balloon assistance), an increasing number of MCA aneurysms are being treated with endovascular occlusion (2-4, 10, 12, 13, 18, 25). No direct comparison between results of surgical and endovascular treatment of MCA aneurysms has been published in the literature, leaving the optimal treatment strategy unclear. The goal of this study was to analyze and present the endovascular and surgical results for MCA aneurysms in a single institution. We included clinical, radiographic, retreatment, and complication rates for both modalities.

MATERIALS AND METHODS

We performed a retrospective analysis of 84 consecutive patients with 90 MCA aneurysms who underwent attempted coil embolization or surgical clipping at our institution between 2005 and 2010. After obtaining approval from all patients for

Table 1. Fifty Patients with Middle Cerebral Artery Aneurysms Undergoing Coil Embolization

Age/Sex	Aneurysm Location	Aneurysm Size (mm)	Presentation	Complications	Obliteration on Follow-Up Angiogram	Length of Angiographic Follow-Up (months)	Modified Rankin Scale at 6 Months
47/F	L MCA	7	SAH		Complete	0	0
35/M	L MCA	5.6	SAH		Complete	0	0
49/M	L MCA	4.2	SAH		Complete	0	0
56/M	R MCA	8	SAH		Near-complete	0	0
44/M	L MCA	6	SAH		Complete	0	2
15/F	R MCA	3	SAH		Complete	0	1
49/M	R MCA	7	SAH		Partial	1	0
57/F	L MCA	6.5	SAH		Near-complete	6	0
48/F	R MCA	4.8	SAH		Complete	9	0
34/F	L MCA	5	SAH		Partial	29	0
72/F	R MCA	3.5	Incidental		Complete	0	0
73/F	R MCA	7.2	Incidental		Complete	0	4
69/M	R MCA	10	Incidental (stroke)		Complete	0	3
63/F	R MCA	8	Incidental (dizziness)	Intraoperative rupture	Partial	0	1
55/F	L MCA	5	Incidental (HA, vision changes)		Complete	0	1
62/F	L MCA	4	Incidental (HA)	Retroperitoneal hematoma	Complete	0	1
50/M	L MCA	10	Multiple (SAH from other aneurysm)	MCA thrombosed postoperatively	Complete	0	4
61/F	R MCA	8	Incidental		Near-complete	0	0
47/F	L MCA	3	Incidental (HA, numbness)		Complete	0	0
51/M	R MCA	10	Incidental (stroke)		Complete	0	0
45/F	L MCA	4.6	Incidental (dizziness)		Complete	0	0
54/F	L MCA	5.5	Incidental (TIA)	L frontal stroke 2 weeks postoperatively	Complete	1	0
54/M	R MCA	25	Incidental (HA, blurry vision)		Partial	5	0
67/F	R MCA	4.6	Incidental (dizziness, falls)	Ipsilateral stroke 1 week postoperatively	Complete	6	4
76/M	L MCA	10	Incidental (HA, falls)		Complete	6	0
62/F	R MCA	5.4	Incidental (HA)		Complete	7	1
72/F	R MCA	5	Incidental (HA)		Complete	7	0
54/M	R MCA	25	Recurrent		Partial	7	0
55/M	R MCA	3.5	Incidental (numbness, weakness)		Complete	8	0
53/F	L MCA	4	Incidental (stroke)		Complete	9	1
66/F	R MCA	13.6	Incidental (subdural hematoma)		Complete	9	0
58/M	R MCA	3.1	Multiple		Complete	10	1
68/M	R MCA	10	Incidental (HA)		Complete	10	0

Demographic information along with aneurysm characteristics, clinical presentation, complications, degree of occlusion on follow-up angiogram, length of angiographic follow-up, and clinical outcomes for all 50 patients with middle cerebral artery aneurysms undergoing endovascular embolization.

MCA, middle cerebral artery; F, female; L, left; SAH, subarachnoid hemorrhage; M, male; R, right; HA, headache; TIA, transient ischemic attack.

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