Endovascular Treatment of Middle Cerebral Artery Dissecting Aneurysms: A 7-Year Single-Center Study

Puyuan Zhao, Deyuan Zhu, Wanling Wen, Yu Zhou, Yibin Fang, Qiang Li, Rui Zhao, Bo Hong, Yi Xu, Jianmin Liu, Qinghai Huang

OBJECTIVE: **To evaluate safety and efficacy of endovascular treatment of middle cerebral artery dissecting aneurysms (MCADAs).**

METHODS: **Between July 2009 and April 2016, 14 patients with MCADAs received endovascular treatment. MCADAs were identified by their unique radiographic features on cerebral angiography. Baseline characteristics, angiographic features, and angiographic and clinical outcomes were analyzed retrospectively.**

RESULTS: **All 14 MCADAs (including 6 ruptured and 8 unruptured) were successfully treated with the endovascular approach. Stent-assisted coiling was used in 12 cases, coil alone in 1 case, and parent vessel occlusion in 1 case. Angiographic follow-up data were available for all patients at 6 months after treatment. Of 14 MCADAs, 10 were completely occluded, and 4 were improved (near occlusion). All parent arteries and covered perforators remained patent in the non—parent vessel occlusion group. No ischemic strokes or other complications were observed at 1-year clinical follow-up.**

CONCLUSIONS: **Our data suggest that endovascular treatment of MCADAs appears to be safe and effective. The choice of treatment method needs to be individualized. Larger studies are required to evaluate these promising results.**

INTRODUCTION

Middle cerebral artery (MCA) dissection manifests predominantly with cerebral ischemia,[1-3] whereas aneurysmal dilated dissection (dissecting aneurysm), which manifests with subarachnoid hemorrhage (SAH), is relatively rare. It is still unclear whether treatment options for these conditions should be the same options used for treatment of vertebral artery dissecting aneurysms. Trapping or coil embolization for vertebral artery dissecting aneurysms has been historically preferred when contralateral blood flow is deemed to be sufficient.[4,5] However, for MCADAs, a deconstructive approach without an efficient bypass is difficult to achieve and poses a great risk of severe hemiparesis or hemiplegia as a result of striatocapsular infarction. We report a 7-year single-center study on endovascular treatment of all consecutive patients with MCADAs between July 2009 and April 2016. Furthermore, we performed a literature review to evaluate the feasibility, safety, and efficacy of endovascular treatment for MCADAs.

MATERIALS AND METHODS

Collection of patient data was approved by the Institutional Review Board of the Second Military Medical University Changhai Hospital.

Patients

From July 2009 to April 2016, 14 patients with MCADAs were treated via the endovascular approach. The inclusion criteria were as follows: 1) all dissecting aneurysms were confirmed by digital

Key words
- Dissecting aneurysm
- Endovascular treatment
- Intracranial aneurysm
- Middle cerebral artery
- Parent vessel occlusion
- Stent-assisted coiling

Abbreviations and Acronyms
ASITN/SIR: American Society of Interventional and Therapeutic Neuroradiology/Society of Interventional Radiology
DSA: Digital subtraction angiography
M1: M1 segment of middle cerebral artery
MCA: Middle cerebral artery
MCADA: Middle cerebral artery dissecting aneurysm
mRS: Modified Rankin Scale
SAH: Subarachnoid hemorrhage

Department of Neurosurgery, Second Military Medical University Changhai Hospital, Shanghai, China

To whom correspondence should be addressed: Qinghai Huang, M.D.; Jianmin Liu, M.D. [E-mail: ocinhqh@163.com; chstroke@163.com]

Puyuan Zhao and Deyuan Zhu are co—first authors.

Citation: World Neurosurg. (2018). https://doi.org/10.1016/j.wneu.2017.12.153

*Journal homepage: **www.WORLDNEUROSURGERY.org***

*Available online: **www.sciencedirect.com***

Table 1. Angiographic and Clinical Results in 14 Middle Cerebral Artery Dissecting Aneurysms Treated with Endovascular Approach

									6 month Angiographic FU		Clinical FU	
Case	Age (years)/Sex	Presentation	Combined Diseases	Location	Strategy	Number of Stents	Instant Raymond Grade	mRS at Discharge	Method	MCADA	Time (months)	mRS
1	40/F	SAH	AcomA An	M1	SAC	2	I	0	MRA	Occluded	12	0
2	59/M	Unilateral limb weakness	MCA An	M1	SAC	1	I	0	DSA	Occluded	94	0
3	65/M	SAH	NA	M1	SAC	2	II	0	DSA	Occluded	26	0
4	60/M	Unilateral limb weakness	NA	M1	SAC	1	II	0	MRA	Improved	17	0
5	48/M	SAH	NA	M2	SAC	1	II	0	MRA	Improved	12	0
6	63/M	Headache	NA	M1	SAC	1	I	0	DSA	Occluded	77	0
7	60/F	Headache	NA	M1	SAC	1	II	0	MRA	Improved	87	0
8	54/M	SAH	DAVF	M1	Coil	0	II	0	DSA	Occluded	76	0
9	67/M	Loss of consciousness	NA	M1	SAC	2	II	0	MRA	Occluded	81	0
10	66/M	Unilateral limb weakness	NA	M1	SAC	2	II	0	MRA	Occluded	12	0
11	22/M	SAH	NA	MCA bif	PVO	0	I	2	MRA	Occluded	34	2
12	59/M	Unilateral limb weakness	NA	M1	SAC	2	II	0	DSA	Occluded	21	0
13	57/M	SAH	NA	M1	SAC	2	II	1	DSA	Occluded	30	0
14	54/F	Headache	NA	M1	SAC	2	III	0	MRA	Improved	12	0

mRS, modified Rankin Scale; FU, follow-up; MCADA, middle cerebral artery dissecting aneurysm; F, female; SAH, subarachnoid hemorrhage; AcomA, anterior communicating artery; An, aneurysm; M1, M1 segment of middle cerebral artery; SAC, stent-assisted coiling; MRA, magnetic resonance angiography; M, male; NA, not applicable; DSA, digital subtraction angiography; M2, M2 segment of middle cerebral artery; DAVF, dural arteriovenous fistula; MCA, middle cerebral artery; bif, bifurcation; PVO, parent vessel occlusion.

subtraction angiography (DSA); 2) dissecting aneurysms were located in the M1 segment of the middle cerebral artery (M1), M2 segment of the MCA, or the MCA bifurcation; and 3) the initial treatment was an endovascular approach. The following patients were excluded: 1) patients with traumatic, iatrogenic, and infective aneurysms; 2) patients with M3 segment or M4 segment of the MCA dissecting aneurysms; and 3) patients without clinical follow-up. Clinical, angiographic treatment, and follow-up data of patients with MCADAs are summarized in Table 1. Mean age of patients was 55.2 ± 12.0 years (range, 22–67 years), and the male-to-female ratio was 11:3. The presentations at hospital admission included SAH in 6 patients, headache in 3 patients, unilateral limb weakness in 4 patients, and loss of consciousness in 1 patient. The Hunt and Hess grades among patients with SAH were 1 in 2 patients, 2 in 1 patient, 3 in 1 patient, and 4 in 2 patients.

Dissecting Aneurysm Identification

All patients had conventional DSA, including three-dimensional reconstructed images, during the procedure. MCADAs were diagnosed when DSA revealed fusiform or irregular dilations of M1, of M2 segment of the MCA, or at the MCA bifurcation with or without stenosis in the affected segment. These dilations typically showed a string sign, a string-and-pearl sign, a pearl sign, a rosette sign, contrast medium retention, pseudoaneurysm, arterial occlusion, or a double lumen sign. All dissecting aneurysms were interpreted by 2 experienced interventionalists (Drs. Xu and Hong). Of the 14 identified MCADAs, lesions were predominantly left-sided; 12 were located at M1, 1 was located at the M2 segment of the MCA, and 1 was located at the MCA bifurcation. There were 2 patients who harbored multiple aneurysms, and 1 patient had an additional dural arteriovenous fistula.

Treatment Strategy and Technique

For the patients who presented with SAH owing to ruptured dissecting aneurysms, we performed endovascular treatment immediately after conventional DSA. For the rest of the cases, timing of the procedure was based on each operator's availability. All endovascular procedures were performed under general anesthesia via the transfemoral approach. Systemic heparinization was administered immediately after sheath placement, using a 5F or 6F guiding catheter (Envoy; Cordis Corp., Miami Lakes, Florida, USA, or Chaperon; MicroVention, Inc., Tustin, California, USA) placed in the distal internal carotid artery. We