ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.surgicalneurologyint.com

Surgical Neurology International

Editor-in-Chief: Nancy E. Epstein, MD, Professor of Clinical Neurosurgery, School of Medicine, State U. of NY at Stony Brook.

SNI: Neurovascular

Editor
Kazuhiro Hongo, MD
Shinshu University, Matsumoto, Japan

SNI
Open Access

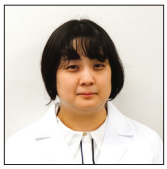
Case Report

Stent assisted coil embolization for a dissecting cerebral aneurysm of middle cerebral artery: A case report and the literature review

Ayaka Shibano[1], Junichi Sakata[1], Atsushi Fujita[2], Tomoaki Harada[1], Reiichi Okino[1], Daisuke Yamamoto[1], Shigeru Miyake[1]

[1]Department of Neurosurgery, Kita-Harima Medical Center, Ono, [2]Department of Neurosurgery, Kobe University Graduate School of Medicine, Kobe, Japan.

E-mail: *Ayaka Shibano - shiba.a.812@gmail.com; Junichi Sakata - junichi.skt@gmail.com; Atsushi Fujita - afujita@med.kobe-u.ac.jp; Tomoaki Harada - harady.tomoaki@hotmail.co.jp; Reiichi Okino - okinor01@gmail.com; Daisuke Yamamoto - daiskeyama@yahoo.co.jp; Shigeru Miyake - miyake@ck9.so-net.ne.jp



***Corresponding author:**
Ayaka Shibano,
Department of Neurosurgery,
Kita-Harima Medical Center,
Ono, Japan.

shiba.a.812@gmail.com

Received: 24 July 2023
Accepted: 22 September 2023
Published: 20 October 2023

DOI
10.25259/SNI_619_2023

Quick Response Code:

ABSTRACT

Background: Dissecting aneurysms of the middle cerebral artery (MCA) are very rare. We herein report a case of an unruptured dissecting aneurysm of the MCA treated by stent-assisted coil embolization.

Case Description: A 65-year-old man with no history of trauma presented with a headache. Time-of-flight imaging revealed a dissecting cerebral aneurysm in the right M1 segment of the MCA, and the aneurysm had increased in size within a short time. We treated the aneurysm by endovascular stenting with coils, and the patient developed no neurological deficits.

Conclusion: Because of the potential involvement of the lenticulostriate artery (LSA) in the area of dissection, choosing the best treatment (such as direct surgery or endovascular treatment) may be challenging. Treatment efficacy depends on whether the LSA is affected and on the length of the dissection. In our case, the dissection did not involve the LSA and could therefore be treated by stent-assisted coil embolization.

Keywords: Dissecting aneurysm, Middle cerebral artery, Stent-assisted coil embolization

INTRODUCTION

Intracranial dissecting aneurysms are rare clinical entities. Most intracranial dissecting aneurysms occur in the vertebrobasilar artery. Dissecting aneurysms in the internal carotid artery (ICA) is uncommon (12.6%).[9] However, dissecting aneurysms in the middle cerebral artery (MCA) is particularly rare. Whether surgery or endovascular treatment is more effective remains unclear. Surgical treatments include trapping, proximal occlusion, reconstruction, resection, coating, and wrapping.[15] Determining the most appropriate treatment strategy is challenging because the lenticulostriate artery (LSA) may be involved in the dissecting lesion. We herein describe a patient who underwent successful stent-assisted coil embolization for an unruptured dissecting aneurysm of the M1 segment of the MCA. Because the dissection was limited to the caudal aspect of the M1 segment, ischemic complications were avoided. Along with a presentation of this case, we discuss the best treatment strategy for dissecting aneurysms of the MCA.

CASE REPORT

A 65-year-old man with no history of trauma developed a headache and presented to the outpatient neurosurgery clinic. He was referred to our department because of a dissecting cerebral aneurysm in the right M1 segment of the MCA [Figures 1a and b]. He was alert and fully conscious, and he exhibited no neurological deficits. However, we noted dilation of M1 in Figures 1a and b, had a headache and decided to follow-up for a short period of time given the possibility of dissection. Magnetic resonance imaging performed 10 days after headache onset revealed enlargement of the dissecting cerebral aneurysm within a short time [Figures 1c and d]. T1-weighted black-blood imaging showed a double lumen of the MCA [Figures 1e and f], suggesting a dissecting aneurysm. Digital subtraction angiography (DSA) performed 13 days after onset showed a 12-mm × 8-mm dissecting cerebral aneurysm in the right M1 segment of the MCA [Figures 2a-d]. The dissection was located in the caudal aspect of the MCA and did not involve the LSA; therefore, we planned endovascular treatment.

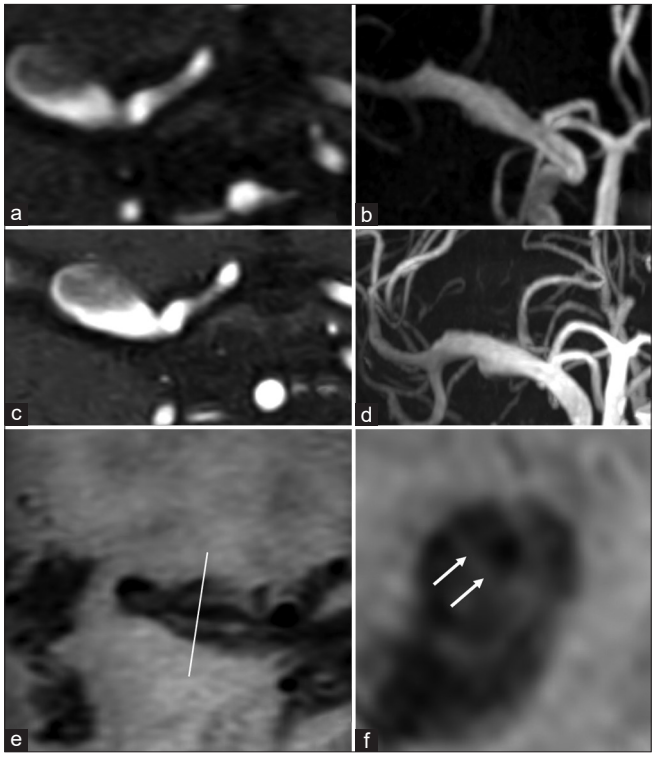


Figure 1: Initial magnetic resonance angiography at presentation. (a) Source imaging, (b) maximum intensity projection showed an enlarged middle cerebral artery, (c, d) 10 days after the onset of the headache, these images showed enlargement of the M1 segment, (e) axial T1-weighted black-blood imaging, and (f) multiplanar imaging showed a double lumen (arrows).

Endovascular procedure

The endovascular therapy was performed 17 days after onset. Dual antiplatelet therapy (aspirin 100 mg and clopidogrel 75 mg) was started 4 days preoperatively. With the patient under general anesthesia, a 9-French (Fr) introducer was placed in the right femoral artery. After systemic heparization, a 9-Fr guiding catheter (Optimo; Tokai Medical Products, Aichi, Japan) was placed in the right common carotid artery, and a 6-Fr distal access catheter (Cerulean DD6 Plus; Medikit, Tokyo, Japan) was placed in the ICA. An ICA angiogram confirmed the increase in the size of the dissecting cerebral aneurysm. A stent delivery microcatheter (Prowler Select Plus; Johnson and Johnson, New Brunswick, NJ, USA) was advanced distally to the dissecting lesion M2 segment, and a coil delivery microcatheter (SL-10; Stryker Neurovascular, Fremont, CA, USA) was then placed in the aneurysm. A 4-mm × 39-mm stent (Enterprise 2 VRD; Codman, Raynham, MA, USA) was deployed from the distal end of the M1 segment to the ICA. Two detachable coils (i-ED ∞3–5 mm × 20 cm, i-ED ∞3–5 mm × 15 cm; Kaneka Corp., Osaka, Japan) were inserted into the aneurysm [Figures 3a-g]. The patient developed no neurological deficits after the procedure.

Postoperative course

On the 1st postoperative day, diffusion-weighted imaging revealed sporadic high-intensity signals in the right cerebral hemisphere [Figures 4a and b]. However, the patient had no neurological deficits. DSA performed 3 days after the procedure

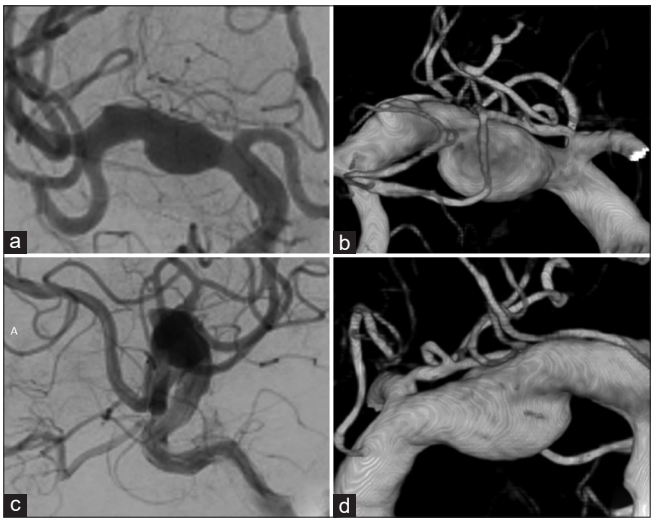


Figure 2: Right internal carotid artery angiograms and three-dimensional digital subtraction angiograms showed a dissecting cerebral aneurysm of the M1 segment. (a and b) Anteroposterior view and (c and d) lateral view. Note that the lenticulostriate artery originates in the dissection area.

showed no in-stent thrombosis and good remodeling of the M1 segment without blood flow into the aneurysm [Figures 4c and d]. On the 11th postoperative day, the patient was discharged home and was able to conduct his daily life without any assistance (modified Rankin scale score of 1). Four months later, DSA showed good patency of the M1 segment with no recurrence of the dissecting aneurysm [Figures 4e and f].

DISCUSSION

Most intracranial dissecting aneurysms are located in the vertebrobasilar artery (87.4%); and dissecting aneurysms in the ICA are uncommon (12.6%).[9] Dissecting aneurysms of the MCA are particularly rare, and those in the distal MCA are rarely reported.[16] With respect to the treatment of intracranial dissecting aneurysms, surgery is recommended for hemorrhagic cases, and conservative therapy is recommended for nonhemorrhagic cases. The most appropriate management of intracranial dissecting aneurysms remains controversial, and the indications for surgical treatment of MCA dissecting aneurysms are not well-defined. There is a consensus that surgical treatment, such as wrapping or trapping with arterial reconstruction, may be appropriate in the presence of subarachnoid

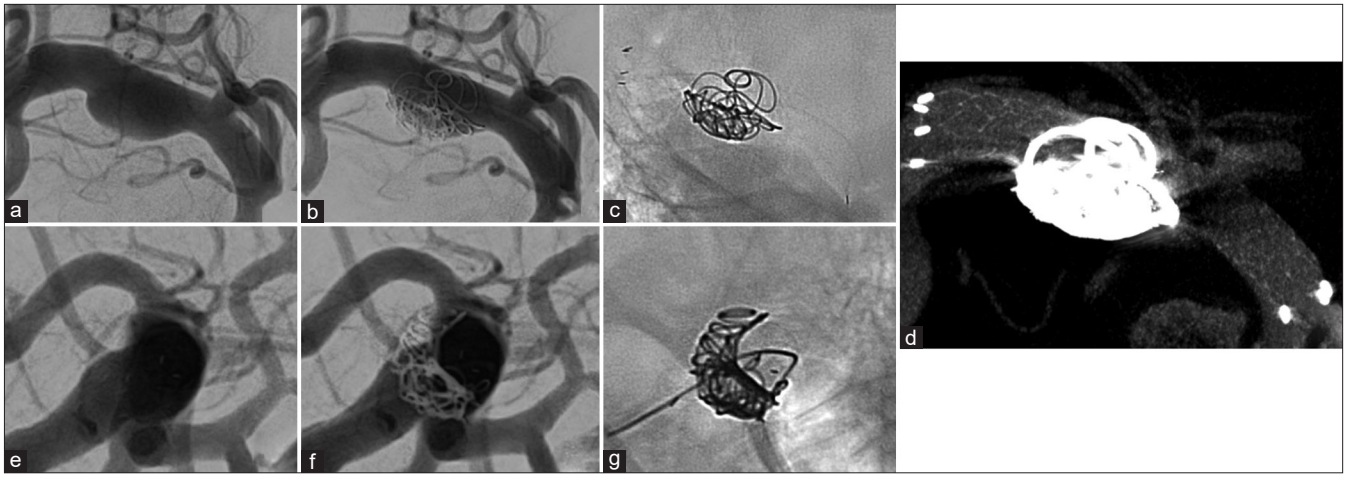


Figure 3: Right internal carotid artery angiograms obtained during treatment.(a-c)Anterior views, (d) anterior views of conbeam computed tomography (CT) and (e-g) lateral views. The middle columns show post stenting with coils, and the right columns show nonsubtracted views.

Table 1: Summary of reported cases of intracranial dissecting MCA aneurysm.

Author, (year)	Age/ Sex	Onset	Location	Intervention	Outcome	Recurrence	Final follow up	Time to treatment	Antiplatelet drug
Kitani (1987)[6]	18/M	ischemia	Rt.M1-M2	STA-MCA	MD	+	3 months	3 days	NA
Kamiyama (1990)[5]	45/F	SAH	Lt.M1	Clipping	GR	NA	NA	NA	NA
Kamiyama (1990)[5]	57/F	ischemia	Rt.M1	STA-MCA	GR	NA	NA	NA	NA
Fu (1996)[4]	38/M	ischemia	Rt.M1	fibrinolysis	GR	-	9 months	3 hours	-
Mizutani (1996)[10]	60/F	ischemia	Lt.ICA-M1	Wrapping	GR	-	39 months	3 months	-
Mizutani (1998)[8]	41/F	SAH	Rt.M1	Wrapping	GR	-	18 months	3 days	-
Abiko (1999)[1]	59/M	SAH	Rt.M1-M2	Bleb clipping	dead	-	2 months	0 days	-
Nimura (2000)[13]	61/F	SAH	Rt.M1-M2	Coating	GR	-	4 years	7 days	-
Niikawa (2002)[12]	46/F	SAH	Rt.M1	Clipping and wrapping	MD	+	16 months	0 days	-
Tada (2004)[15]	54/F	ischemia	Lt.M1-M2	Coating	GR	-	1 months	13 days	-
Ozaki (2018)[14]	74/F	SAH	Lt.M1	Stent coil	GR	-	6 months	8 days	aspirin 300 mg + clopidogrel 300 mg
Present case	65/M	headache	Rt.M1	Stent coil	GR	-	4 months	17 days	aspirin 100 mg + clopidogrel 75 mg

STA: Superficial temporal artery, MCA: Middle cerebral artery, MD: Moderately disabled, NA: Not avairable, GR: Good recovery, SAH: Subarachnoid hemorrhage, M/F: Male/Female, Rt: Right, Lt: Left.

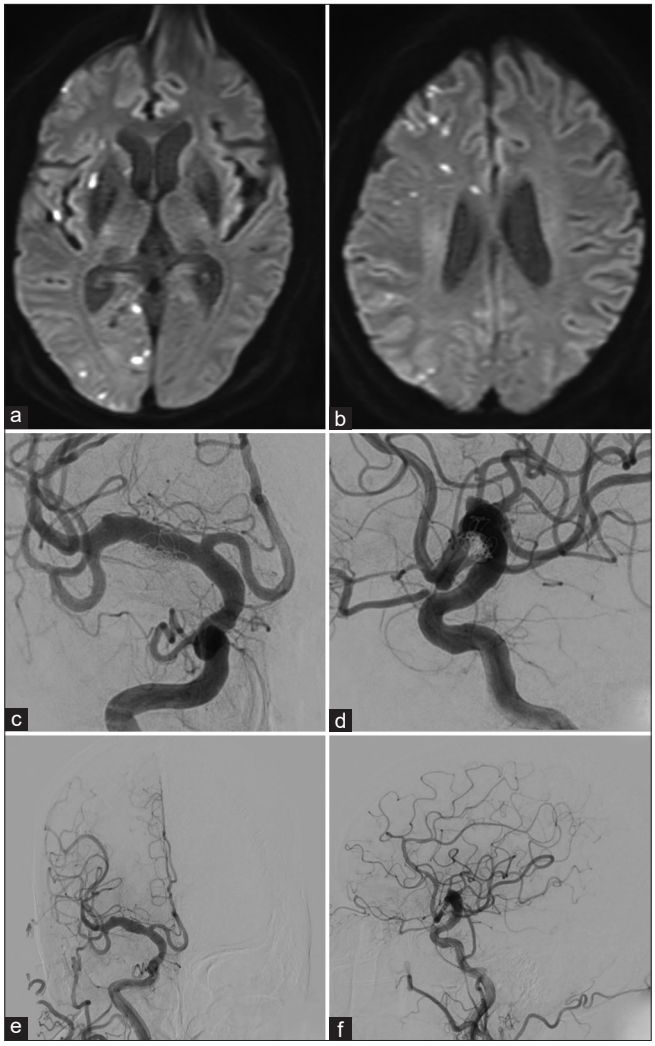


Figure 4: (a and b) Postoperative diffusion-weighted imaging revealed sporadic areas of high signal intensity in the right cerebral hemisphere, (c and d) digital subtraction angiograms obtained 3 days after treatment showed complete occlusion of the dissecting lumen and good remodeling of the M1 segment. (e and f) Four-month follow-up angiograms showed complete obliteration of the dissecting aneurysm with preservation of the M1 segment.

hemorrhage because subsequent bleeding often leads to poor outcomes.[11] Asymptomatic patients should be observed unless serial neuroimaging assessments indicate significant enlargement of the aneurysm. Treatment modalities vary and may include bypass, coating, wrapping, and stent-assisted coil embolization.

Dissecting aneurysms of the MCA are very rare and have been described in only 11 case reports.[1,4,5,6,8,10,12,13,14,15] Table 1 presents a summary of the reported cases, including our own. Of all 12 cases, 6 (50%) resulted in subarachnoid hemorrhage and 5 (41.7%) resulted in ischemic stroke. Our patient developed a headache with neither hemorrhagic nor ischemic complications. Nine patients underwent direct surgery, and three underwent endovascular treatment. Nine (75%) patients had a good clinical course, and only one patient died. Ozaki *et al.* reported stent-assisted coil embolization for a dissecting aneurysm of the MCA with a hemorrhagic presentation and concluded that choosing a treatment strategy is extremely difficult for cases, in which the LSA is involved in the dissecting lesion.[14]

Treatment of an MCA dissecting aneurysm is challenging because the lesion may involve the LSA. There are few reports on the surgical or endovascular treatment of MCA dissecting aneurysms. Because of the presence of perforating arteries, wrapping is often performed for dissecting aneurysms of the M1 segment and the M1–M2 junction. However, the risk of rupture remains. Dissecting aneurysms of the M2 segment are treated with bypass and trapping because there are fewer perforators from the M2 segment.[3,7,15] Nevertheless, wrapping is associated with a risk of re-rupture, and bypass and trapping cannot completely prevent ischemic stroke.

Dissecting cerebral aneurysms of the M1 segment of the MCA is particularly difficult to treat surgically because of the potential presence of the LSA in the dissecting lesion. Treatment efficacy depends on whether the LSA is affected and on the length of the dissection.

In our case, the LSA was contralateral to the dissection, and we were thus able to preserve it after stent-assisted coil embolization.

The occlusion rate of craniotomy clipping surgery is 94.2%, and the occlusion rate of simple coil technique is 54.2%, while the occlusion rate of flow diverter (FD) is about 80%, which is a good result. A meta-analysis of FD treatment for 244 MCA aneurysms reported 20.7% complications and 10% reported permanent neurological sequelae. Unlike the favorable results of FD treatment for aneurysms in the anterior circulation, many of them have been reported to be due to perforator ischemia covered by FD, and they concluded that caution is required in its indication.[2] In the future, with the accumulation of further cases, FD may replace the treatment of aneurysms in this area. Our patient was successfully treated with placement of a self-expanding closed-cell stent and coil embolization, preserving blood flow to both the LSA and MCA.

CONCLUSION

We have reported a case of an unruptured dissecting aneurysm of the MCA that was successfully treated by stent-assisted coil embolization. The best treatment option for this condition is difficult to determine, and an accurate assessment of imaging findings is crucial.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author(s) confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Abiko S, Okamura T, Kurokawa Y, Ikeda N, Ideguchi M, Watanabe K. Diagnosis and treatment of nontraumatic dissecting aneurysm in the middle cerebral artery. No Shinkei Geka 1999;27:743-9.
2. Cagnazzo F, Mantilla D, Lefevre PH, Dargazanli C, Gascou G, Costalat V. Treatment of middle cerebral artery aneurysms with flow-diverter stents: A systemic review and meta-analysis. AJNR Am J Neuroradiol 2017;38:2289-94.
3. Day AL, Gaposchkin CG, Yu CJ, Rivet DJ, Dacey RG Jr. Spontaneous fusiform middle cerebral artery aneurysms: Characteristics and a proposed mechanism of formation. J Neurosurg 2003;99:228-40.
4. Fu Y, Komiyama M, Inoue T, Ohata K, Matsuoka Y, Hakuba A. A case of middle cerebral artery occlusion caused by dissecting aneurysm. No Shinkei Geka 1996;24:955-9.
5. Kamiyama H, Nomura M, Abe H, Abumiya T, Saito H, Yamauchi T, *et al*. Diagnosis for the intracranial dissecting aneurysms. Surg Cereb Stroke 1990;18:50-6.
6. Kitani R, Itouji T, Noda Y, Kimura M, Uchida S. Dissecting aneurysms of the anterior circle of willis arteries. Report of two cases. J Neurosurg 1987;67:296-300.
7. Mizutani T. Natural course of intracranial arterial dissections. J Neurosurg 2011;114:1037-44.
8. Mizutani T. Surgical considerations for cerebral dissecting aneurysms. Surg Cereb Stroke 2002;30:424-8.
9. Mizutani T. Middle cerebral artery dissecting aneurysm with persistent patent pseudolumen. J Neurosurg 1996;84:267-8.
10. Mizutani T. Subarachnoid hemorrhage associated with angiographic "stenosis" or "occlusive" lesions in the carotid circulation. Surg Neurol 1998;49:495-504.
11. Nam DH, Park SK. Endovascular treatment in ruptured middle cerebral artery dissection preservation of arterial continuity. J Cerebrovasc Endovasc Neurosurg 2015;17:108-12.
12. Niikawa S, Yamada J, Sumi J, Yamakawa H. Dissecting aneurysm of middle cerebral artery manifesting as subarachnoid hemorrhage and hemorrhagic infarctions. Case report. Neurol Med Chir(Tokyo) 2002;42:62-6.
13. Nimura T, Oku T, Narita N, Higuchi H. A case of middle cerebral artery dissecting aneurysm. No Shinkei Geka 2000;28:61-5.
14. Ozaki T, Nishida T, Fujita Y, Kishima H, Kinoshita M. Coil and single-stent placement for ruptured dissecting aneurysm of middle cerebral artery: A case report. World Neurosurg 2018;113:208-11.
15. Tada Y, Kannuki S, Koyama Y. Dissecting aneurysm of the middle cerebral artery growing during long-term follow-up: A case report. Surg Cereb Stroke 2004;32:370-5.
16. Zhao T, Zhu D, Wen W, Zhuo Y, Fang Y, Li Q, *et al*. Endovascular treatment of middle cerebral artery dissecting aneurysms: A 7-year single-center study. World neurosurgery, 2018;112:119-24.

How to cite this article: Shibano A, Sakata J, Fujita A, Harada T, Okino R, Yamamoto D, *et al*. Stent assisted coil embolization for a dissecting cerebral aneurysm of middle cerebral artery: A case report and the literature review. Surg Neurol Int 2023;14:375.