

Ischemic Stroke Due to Dissection of the Middle Cerebral Artery Treated by Superficial Temporal Artery-Middle Cerebral Artery Anastomosis

—Case Report—

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Abstract

A 62-year-old man presented with dissection of the right middle cerebral artery (MCA) manifesting as mild headache, right hemiparesis, and slurred speech. Magnetic resonance (MR) imaging and MR angiography revealed fresh infarction in the right basal ganglia, and severe stenosis and dilatation of the right MCA. Digital subtraction angiography approximately 24 hours after admission revealed a linear contrast defect indicating an intimal flap of the M₁ segment. The diagnosis was dissection of the MCA. His neurological deficits improved gradually. Although he was neurologically stable, diffusion-weighted MR imaging revealed enlarging infarct size over the right MCA territory, and the right M₁ segment had progressive stenosis. Superficial temporal artery (STA)-MCA anastomosis was performed on the 26th day. Follow-up angiography showed good patency of the STA-MCA anastomosis, repair of the dissection of the M₁ segment, and improvement of the flow in the MCA. The patient was discharged from our hospital with no neurological deficits. Although the dissection in this case was spontaneously repaired, STA-MCA anastomosis was useful to get through a critical time. If the stenosis shows further progression or the infarction size enlarges, STA-MCA anastomosis may be effective.

Key words: cerebral infarction, middle cerebral artery, dissection, superficial temporal artery-middle cerebral artery anastomosis, magnetic resonance angiography

Introduction

Arterial dissection in the anterior circulation is relatively rare compared with the posterior circulation, but often results in severe morbidity or mortality due to cerebral infarction or hemorrhage.^{1,5,6,12,15,17,19} Arterial dissections of the anterior circulation can also cause subarachnoid hemorrhage (SAH),^{5,12,21} may be associated with cerebral ischemia, and result in complete stroke due to arterial stenosis or occlusion. Cerebral artery dissection may be responsible for ischemic events in children.² Dissection of the middle cerebral artery (MCA) has been increasingly reported in recent years. The typical initial clinical symptoms are sudden appearance of headache, hemiparesis, dysarthria, and disturbance of consciousness with hemispheric functional loss. The natural course of this dissection remains unclear and the surgical indications for this type of dissection with ischemic onset are controversial. Bypass surgery has been proposed in selected patients, but the clinical application is not well defined.^{7,16,22,23}

We report a rare case of rapidly progressive ischemic stroke caused by dissection of the right MCA in a patient who underwent superficial temporal artery (STA)-MCA anastomosis. Progression of the dissection was demonstrated by magnetic resonance (MR) imaging, MR angiography, computed tomography (CT) angiography, digital subtraction (DS) angiography, and single photon emission computed tomography (SPECT).

Case Report

A 62-year-old man presented to our emergency department after noticing mild headache, right hemiparesis, and slurred speech. He had previously been healthy with no history of head injury. MR imaging, MR angiography, and CT angiography were taken 6 hours after onset. Diffusion-weighted MR imaging revealed fresh infarction in the right basal ganglia (Fig. 1A). MR angiography and CT angiography showed the right M₁ segment was severely stenotic and T₂*-weighted MR imaging revealed a dilatation (Fig. 1B, C). Perfusion CT showed no decrease in cerebral blood flow (CBF) in the right hemisphere. DS angiography approximately 24 hours after admission rev-

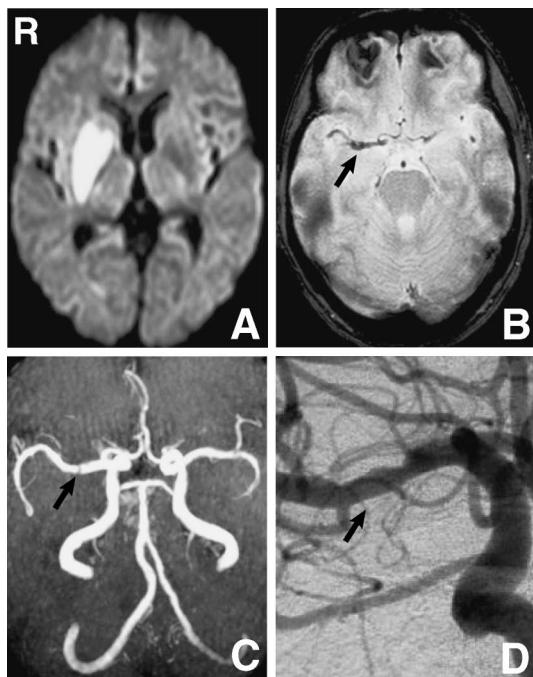


Fig. 1 A: Diffusion-weighted magnetic resonance (MR) image on the day of admission showing fresh infarction in the right basal ganglia. B: T_2^* -weighted MR image on admission revealing a dilatation (arrow) of the right middle cerebral artery (MCA). C: MR angiogram on admission showing severe stenosis (arrow) in the right MCA. D: First right carotid angiogram approximately 24 hours after admission revealing a linear contrast defect (arrow) indicating an intimal flap from the proximal to the distal portions of the M₁ segment.

ealed a linear contrast defect indicating an intimal flap from the proximal to the distal portions of the M₁ segment (Fig. 1D). Based on these findings, the diagnosis was dissection of the right MCA. He was administered aspirin 100 mg/day orally.

On the day after admission, he was beginning to show some improvement in speech and motor function. His neurological deficits improved gradually. MR angiography on the 7th day after admission revealed progress of the stenosis in the M₁ segment (Fig. 2A). Although he was neurologically stable, diffusion-weighted MR imaging on the 21st day after admission revealed enlarging infarct size over the right MCA territory, and progressive stenosis in the right M₁ segment, gradually delaying the flow of the MCA as seen on MR, CT, and DS angiography (Fig. 2B-D). SPECT demonstrated decreased CBF at rest (≤ 30 ml/100 g/min) and reduced reactivity to acetazolamide (cerebral blood volume [CVR] $\leq 10\%$) in the right parietal and temporal lobes (Fig. 3A). To prevent further aggravation of the infarction due to the progressive dissection, we performed double STA-MCA anastomosis on the 26th day.

The postoperative course was uneventful and no neurological deficits occurred. Diffusion-weighted MR imaging on the 17th day after the procedure revealed no enlargement of the infarction and MR angiography revealed im-

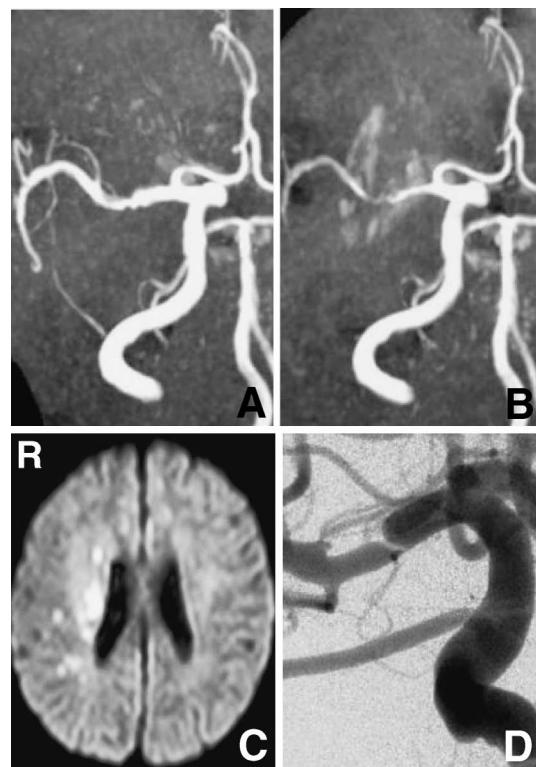


Fig. 2 A, B: Magnetic resonance (MR) angiograms obtained on days 7 and 19 showing progressive stenosis of the right M₁ segment gradually delaying the flow of the middle cerebral artery (MCA). C: Diffusion-weighted MR image on the 21st day after admission revealed enlarging infarct size over the right MCA territory. D: Right carotid angiogram obtained on day 23 showing progressive stenosis in the right M₁ segment causing delay of flow in the MCA.

provement of the stenosis of the MCA (Fig. 4A). Follow-up angiography on the 18th day after surgery showed good patency of the STA-MCA anastomosis, repair of the dissection of the M₁ segment, and improvement of the flow of the MCA (Fig. 4B, C). SPECT showed improved CBF and CVR in the right temporal and parietal lobes (Fig. 3B). He was discharged from our hospital with no neurological deficit on the 23rd day after the procedure.

Discussion

The characteristics of the present case that led to the diagnosis of arterial dissection were: occurrence in a young adult, headache as an initial symptom, intimal flap with direct evidence on angiography, and structural change from stenosis to occlusion within a short period.^{4,8,11,17)} Angiographic demonstration of an intimal flap, false lumen, or pseudoaneurysm is relatively uncommon.

Dissection of the MCA generally occurs at the sphenoidal portion (M₁ segment), and typically branch dissection is a consecutive lesion from the M₁ segment.¹⁷⁾ If dissection of the MCA is suspected, diagnostic examinations and DS angiography should be performed immediately because of the possibility of dynamic changes over a

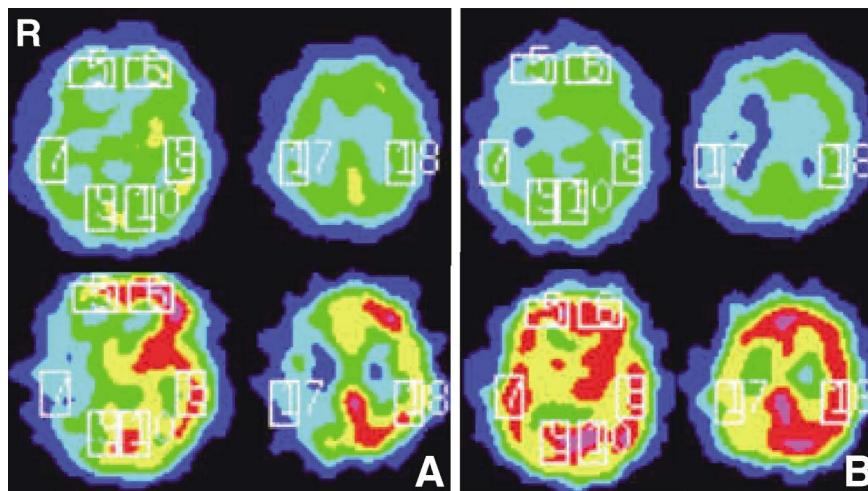


Fig. 3 A: Single photon emission computed tomography (SPECT) scans on the 21st day after admission showing decreased cerebral blood flow (CBF) at rest ($\leq 30 \text{ ml}/100 \text{ g}/\text{min}$) and reduced reactivity to acetazolamide (cerebral blood volume [CVR] $\leq 10\%$) in the right parietal and temporal lobes. B: SPECT scans on the 42nd day after admission (16th day after surgery) showing improved CBF and CVR in the right temporal and parietal lobes.

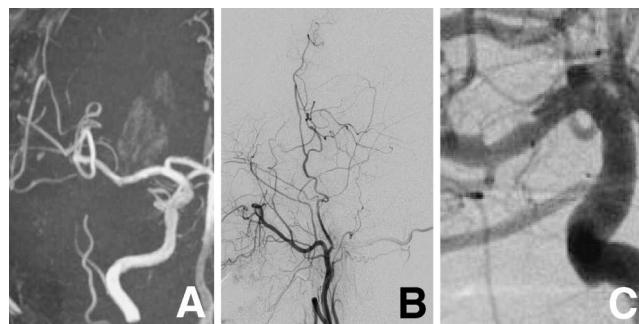


Fig. 4 A: Magnetic resonance angiogram on day 43 (17th day after surgery) revealing good patency of the superficial temporal artery (STA)-middle cerebral artery (MCA) anastomosis and improvement of the stenosis of the MCA. B, C: Right carotid angiograms on day 44 (18th day after surgery) showing good patency of the STA-MCA anastomosis, repair of the dissection of the M₁ segment, and improvement of the flow of the MCA.

short time.⁸⁾ Although surgical treatment such as wrapping, coating, or trapping may be appropriate in the presence of SAH, the treatment for ischemic symptoms remains controversial since subsequent bleeding often leads to poor outcomes. Extensive lesions of dissection seen on angiography have resulted in a wide range of cerebral infarction and poor prognosis.¹⁰⁾ Infarction was observed not only in the territory of the MCA branches but also in the territory of the lenticulostriate artery originating from the M₁ segment.¹⁷⁾

Medication used for infarction due to other causes, such as fibrinolytic drugs, and anticoagulant or antiplatelet drugs, might not be effective for arterial stenosis caused by dissection. Administration of these drugs may also increase the risk of SAH at the dissection. Anticoagulants may be harmful in these patients because of the risk of hemorrhagic transformation or even progressive dissection.²⁰⁾ Intracranial dissection with ischemic onset may bleed at the next attack.^{14,24)} Most patients with acute ischemic change with dissection had poor outcome with

conventional intravenous recombinant tissue plasminogen activator thrombolysis treatment.⁹⁾ The optimum medical treatment for infarction due to dissection has not been established and should be clarified.

Surgical treatment such as trapping and STA-MCA anastomosis may be considered if the MCA dissection involves cerebral infarction. Three of four patients with the natural course deteriorated with cerebral infarction due to MCA dissection and made a poor recovery, with neurological deficits, such as hemiparesis, caused by infarct.⁷⁾ Five of seven patients with MCA dissection and ischemia who were treated conservatively subsequently died.⁸⁾ In contrast, outcomes in surgically treated patients were relatively good. Patients with MCA dissection had sudden aggravations after 7 to 15 days of uneventful acute course after the first attack due to recurrent attacks as determined by clinical and imaging findings.¹⁸⁾ If follow-up angiography indicates progress of the dissection or the clinical symptoms deteriorate, surgery should be performed immediately. Endovascular treatment for internal carotid artery dissection can be successful, but the problem of perforators presents difficulties in MCA dissection.¹³⁾ A case of MCA occlusion due to dissection was successfully treated by intra-arterial fibrinolysis.³⁾ Despite the risk of hemorrhage, the endovascular technique may be considered in high risk patients undergoing direct surgery.

Our patient was discharged with no neurological deficits during treatment or follow up, but the infarction enlarged and the CBF decreased because of progress of the M₁ stenosis. Close observation with DS angiography, MR angiography, and SPECT for any clinical symptoms, including mild headache and temporary neurological deficits, is essential. Noninvasive MR imaging and MR angiography are useful for follow up of the dissection. Although the dissection in this case was spontaneously repaired, the STA-MCA anastomosis was useful to get through a critical time.

The present case suggests that careful follow-up serial angiography and MR imaging/angiography will be necessary because the dissection of the MCA may progress. If the MCA dissection involves cerebral infarction and is lo-

cated at a proximal site on a major branch, surgical treatment must be considered.⁸⁾ If the stenosis shows progression, the infarction size is enlarged or CBF is decreased, STA-MCA anastomosis may be effective.

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