

Case Report

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Distal Middle Cerebral Artery M4 Aneurysm Surgery Using Navigation-CT Angiography

Unruptured non-traumatic dissecting aneurysm in the M4 segment of the middle cerebral artery (MCA) accompanied by complete occlusion of the ipsilateral internal cerebral artery (ICA) has never been reported. A 41-year-old man presented with an infarction manifesting as left-sided weakness and dysarthria. Magnetic resonance angiography revealed a subacute stage infarction in the right MCA territory and complete occlusion of the right ICA. Angiography demonstrated aneurysmal dilatation of the M4 segment of the right MCA. Surgery was performed to prevent hemorrhage from the aneurysm. The aneurysm was proximally clipped guided by Navigation-CT angiography and flow to the distal MCA was restored by superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis. We report this rare case with literature review.

KEY WORDS : Middle cerebral artery aneurysm · Navigation · Dissecting aneurysm.

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INTRODUCTION

The vast majority of middle cerebral artery (MCA) aneurysms occur at the division of the M1 trunk, and these aneurysms account for 80% to 85% of all MCA aneurysms⁶. Distal MCA aneurysms are relatively rare, constituting only 4% to 5% of all MCA aneurysms³. In addition, dissecting aneurysms in MCA are rare with only 27 cases reported⁴. And, the majority of distal MCA aneurysms are located at the M2 or M3 segments.

We present a rare case of an M4 unruptured non-traumatic dissecting aneurysm located deep in the subcortical white matter accompanied by proximal internal carotid artery (ICA) occlusion. This aneurysm was treated through proximal ligation of the M4 aneurysm guided by Navigation-CT angiography and anastomosis of the superficial temporal artery (STA) to the MCA.

CASE REPORT

A 41-year-old man developed left-sided weakness and speech disturbance on five days before admission. He did not have any specific medical problems, such as hypertension, diabetes mellitus, hypercholesterolemia, infectious disease, head trauma, or heart disease. On inspection of neurological status, he was alert, but showed dysarthria. His motor power was grade II in his left upper extremity and grade III in left lower extremity.

Magnetic resonance image (MRI) on admission showed a subacute infarction in the right MCA territory and magnetic resonance angiography (MRA) showed complete occlusion of the right ICA. Angiography revealed an aneurysmal dilatation of the

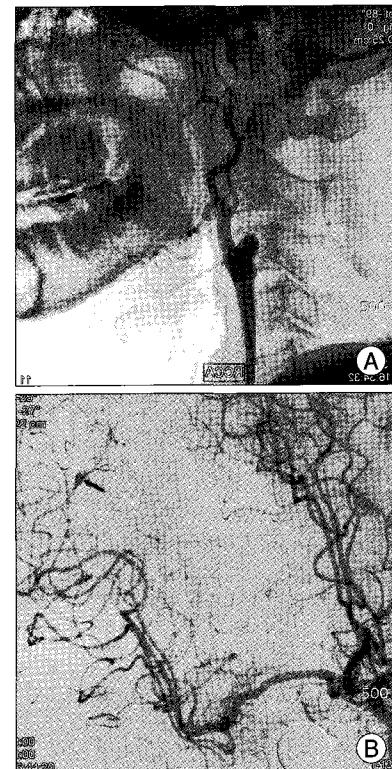


Fig. 1. Cerebral angiogram revealing right internal carotid artery occlusion (A). Anteroposterior angiogram demonstrating aneurysmal dilatation of the M4 segment of the right middle cerebral artery (B).

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M4 segment of the right MCA, but it was located at a depth of 18.9 mm deep from the cerebral cortical surface (Fig. 1). Diamox-SPECT showed moderately decreased perfusion/reserve capacity in the right MCA territory (Fig. 2).

One month after the onset of the infarction, we planned to operate on the M4 aneurysm and ICA occlusion. Initially, we only planned to perform STA-MCA anastomosis due to

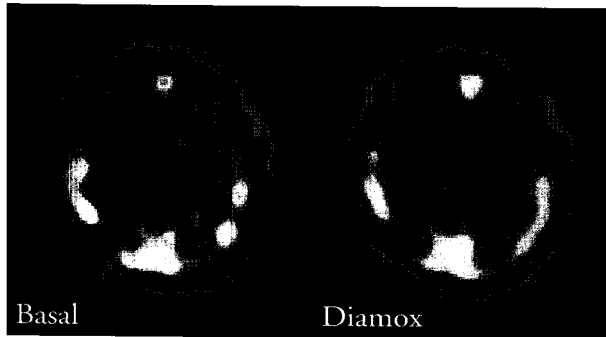


Fig. 2. Axial view of cerebral perfusion SPECT with acetazolamide challenge showing a lack of vasodilatory reserve in the right middle cerebral artery territory.



Fig. 3. 3D-computed tomography angiography reconstructed with 3D imaging software (Phillips Brilliance, 64 channel, Rapidia) showing an aneurysm in the distal M4 segment located 18.9 mm from the cortical surface.

the decreased perfusion/reserve capacity of the right MCA territory. However, after considering the possibility of an M4 aneurysm rupture occurring after STA-MCA anastomosis due to the increase in cerebral blood flow, we decided to first trap the M4 aneurysm and then to perform STA-MCA anastomosis surgery. We prepared the navigation based on CT angiography for surgery of the deeply seated aneurysm (Fig. 3). Right frontotemporal craniotomy was performed. The sulci presumed to be located near the aneurysm were carefully explored under the guidance of Navigation-CT angiography, and an aneurysm was found to arise from the M4 segment. The aneurysm did not have a neck portion, and it was therefore thought to be a fusiform aneurysm. The trapping was impossible due to the deep location of the aneurysm and further parenchymal injury. Thus, the proximal artery of the aneurysm was clipped (Fig. 4). We then performed STA-MCA anastomosis connecting the STA and angular branch of the MCA.

Follow-up angiography 14 days after operation demonstrated the complete absence of the aneurysm and the STA-MCA anastomosis, with good filling in the distal part of the anastomosis. The neurological status of the patient improved dramatically that his dysarthria nearly disappeared, and his weakness improved to motor power grade IV⁺.

DISCUSSION

Most MCA aneurysms have been found at the division of the M1-M2 junction due to hemodynamic stress or congenital factors³⁾, and they frequently appear as saccular aneurysms. On the

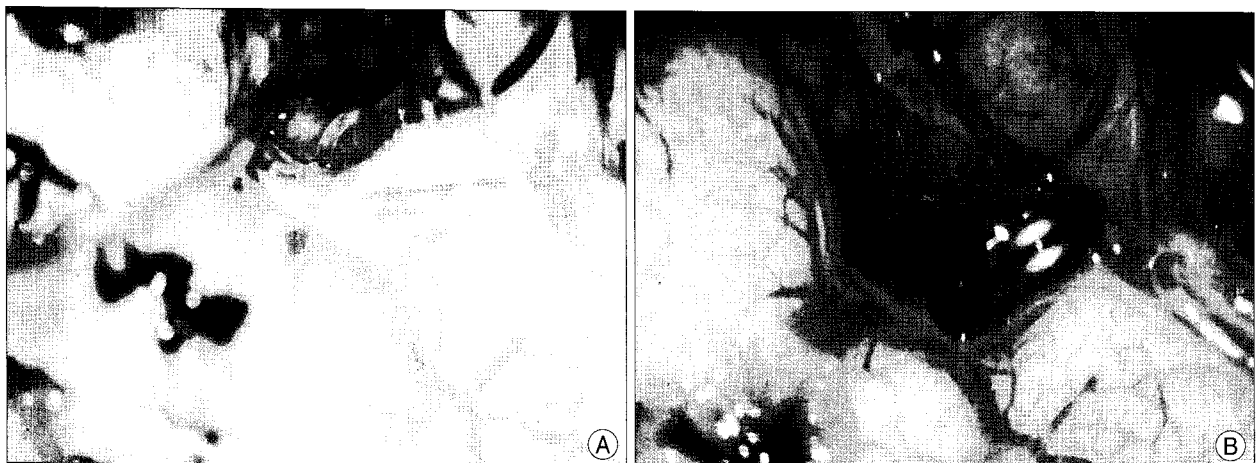


Fig. 4. A fusiform aneurysm was visualized without cortex injury (A). The proximal part of aneurysm was clipped with a Yasagil clip (B).

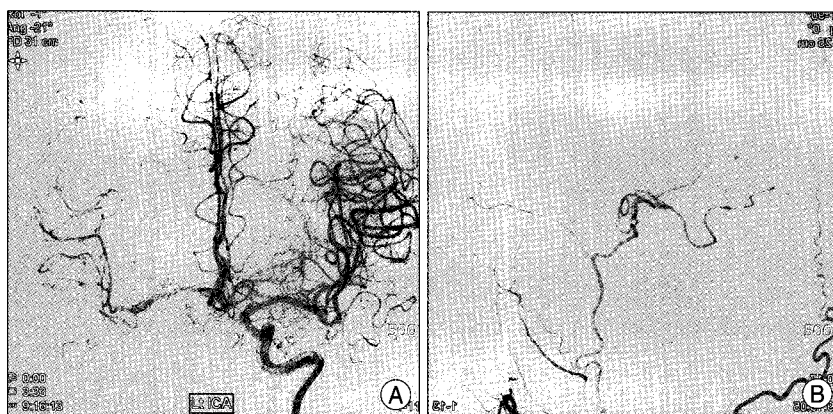


Fig. 5. Cerebral angiogram performed 14 days after the operation shows the absence of an M4 aneurysm (A) and superficial temporal artery-middle cerebral artery anastomosis, which had good vascular integrity (B).

other hand, distal MCA aneurysms, especially dissecting aneurysms are rare. There are just four reported cases of spontaneous dissecting aneurysms of the M3 segment or more distal locations⁴⁾, and only one case of saccular aneurysm has been reported in the literature¹⁾. However, most of these cases were ruptured aneurysms, and the patients had no other vascular diseases. In our patient, there was an unruptured non-traumatic M4 dissecting aneurysm located deep within the parenchymal tissue accompanied by ICA occlusion. In such case, it is necessary to determine the exact location of the M4 dissecting aneurysm at the operative field and to divert the blood flow into the distal MCA in order to prevent further ischemia.

We used Navigation-CT angiography, which combined neuronavigation systems with three-dimensional (3D) computed tomographic angiography, to locate the M4 aneurysm. Schmid-Elsaesser et al.⁵⁾ reported the usefulness of Navigation-CT angiography when performing surgery on unruptured aneurysms, especially those located in the MCA. They reported that the deviation of the neck in Navigation-CT angiography was less than 2.6 mm and that, with this instrument, MCA aneurysms was approached via minicraniotomy avoiding detachment of the temporalis muscle. With the assistance of this instrument, we were able to accurately locate the aneurysm without corticotomy, and we were able to avoid causing further cortical injury by approaching through sulci.

The routine surgical treatment for dissecting aneurysms of the main trunk of MCA is bleb clipping and wrapping in order to preserve the perforating artery, while that for distal part aneurysms, such as those located in the M2 or M3 segments, is resection, trapping or proximal ligation and STA-MCA anastomosis, if possible, in order to maintain MCA flow distal to the lesion⁴⁾. Our patient had distal M4 aneurysm associated with ipsilateral ICA occlusion, and a

Diamox-SPECT scan showed moderately decreased perfusion/reserve capacity in the right MCA territory, indicating that he needed an additional supply of blood flow. We therefore clipped the proximal portion of the aneurysm and performed STA-MCA anastomosis using the end-to side method.

Here, preventive surgery was performed in a 41-year-old man with an unruptured dissecting aneurysm of the M4 segment of the MCA. This is the first report of aneurysmal dilatation of the M4 segment accompanied by

total occlusion of the ipsilateral ICA without any other cause. Generally, aneurysms located in the distal portion of the MCA are caused by head trauma, vasculitis, atherosclerosis, neoplastic emboli, or bacterial infection²⁾. However, in this patient, we could not find any other medical problem that could have been associated with the development of the aneurysm. The authors suspected that certain hemodynamic stresses resulting from the occlusion of the ICA might have given rise to the development of an aneurysm in the distal portion of the MCA.

CONCLUSION

We experienced a rare case of an unruptured non-traumatic dissecting aneurysm of the M4 segment of the MCA accompanied by the total occlusion of the ipsilateral ICA. We treated M4 aneurysm with proximal ligation guided by Navigation-CT angiography and ICA occlusion with STA-MCA anastomosis for decreased reserve capacity.

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