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**Direct Clipping of a Thrombosed Giant Cerebral
Aneurysm After Thrombectomy Without Bleeding to
Minimize the Temporary Occlusion Time**
—Technical Case Report—

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Abstract

A 75-year-old man was referred to our hospital with a thrombosed giant middle cerebral artery aneurysm manifesting as progressive memory disturbance and disorientation. Magnetic resonance imaging and conventional angiography revealed a partially thrombosed giant aneurysm of the left middle cerebral artery bifurcation and edema of the adjacent brain which had enlarged compared to 3 months before. Surgery was performed through a left frontotemporal craniotomy. After exposure of the aneurysm neck, we tried to apply a clip, which slipped due to the intraaneurysmal thrombus. Intraoperative motor evoked potential monitoring showed decreased amplitude. Therefore, the aneurysm dome was incised and the intraaneurysmal thrombus near the neck was shaved with the ultrasonic aspirator, followed by neck clipping of the aneurysm. The residual thrombus was safely removed. Transient right hemiparesis was observed after surgery, but his memory disturbance gradually improved. Giant thrombosed aneurysm can be treated by reduction of the thrombus from the far side to the lumen to reduce the duration of parent artery occlusion required for clipping.

Key words: giant cerebral aneurysm, thrombosed aneurysm, clipping, thrombectomy, cavitron ultrasonic surgical aspirator

Introduction

Treatment of a thrombosed giant cerebral aneurysm is one of the most difficult neurosurgical challenges. Giant thrombosed aneurysm cannot be simply eradicated by conventional clipping, especially if the intraaneurysmal thrombus around the neck is organized. Therefore, several innovative techniques such as thrombectomy and clip reconstruction or bypass with parent artery occlusion have been proposed. However, the optimal treatment is clipping of the aneurysm to achieve complete occlusion while maintaining the physiological arterial blood flow. In particular, the period of trapping of the artery should be minimized in patients with little tolerance of parent artery occlusion.⁶⁾

Here, we report a case of partially thrombosed giant middle cerebral artery (MCA) aneurysm successfully treated by direct neck clipping after thrombectomy using ultrasonic aspiration, which did not require opening of the vascular lumen and minimized the period of temporary occlusion of the MCA.

Case Report

A 75-year-old man presented with progressive memory disturbance and confusion. He had a history of loss of consciousness 2 years previously, followed by progressive memory disturbance and disorientation during the last year. A giant thrombosed aneurysm of the left MCA was identified at another hospital one year previously. Magnetic resonance (MR) imaging 2 months before admission revealed a round mass of 3 cm diameter in the left temporal lobe appearing as mixed signal intensity with increased perifocal edema.

On admission, he was confused and restless. He had severe memory disturbance and score 0 on the dementia scale, but without motor paresis or sensory disturbance. MR imaging revealed the aneurysm had a much larger external diameter than internal luminal diameter, consistent with eccentric thrombus (Fig. 1A). Digital subtraction angiography (DSA) showed an aneurysm of 1 cm diameter at the left MCA bifurcation (Fig. 1B). Three-dimensional computed tomographic angiography confirmed these findings (Fig. 2A). Our diagnosis was giant aneurysm containing eccentric thrombus at the left MCA bifurcation. Our strategy for treatment was to eliminate the blood flow into the aneurysm and remove the thrombosed mass. We also planned to perform superficial temporal artery (STA)-MCA anastomosis if trapping of the aneurysm was required.

Left frontotemporal craniotomy was performed under continuous motor evoked potential (MEP) monitoring. The left STA was preserved at the time of skin incision in preparation for anastomosis to the left MCA. A stimulation probe was inserted toward the motor cortex. Then the left sylvian fissure was dissected to expose the MCA bifurcation. The huge eccentric thrombus inside the aneurysm sac with a soft pink neck was buried in the temporal lobe (Fig. 2B). First, a straight clip was applied to the neck, but the clip slipped onto the parent artery, and the MEP ampli-

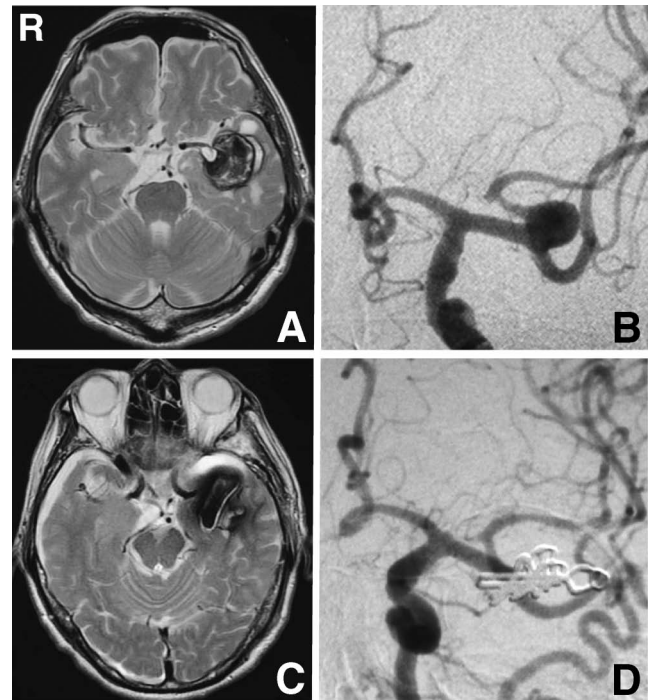


Fig. 1 A: T₂-weighted magnetic resonance (MR) image on admission revealing a round mass of 3 cm diameter in the left temporal lobe appearing as mixed signal intensity, with the internal lumen depicted as high intensity, and the intraaneurysmal thrombus as a low intensity. B: Digital subtraction angiogram (DSA) before the operation demonstrating an aneurysm of 1 cm diameter at the left middle cerebral artery (MCA) bifurcation. C: MR image after the operation revealing disappearance of the mass and edema in the left temporal lobe. D: Postoperative DSA showing successful clipping of the aneurysm and preservation of the branch of the left MCA.

tude diminished after a short period of MCA occlusion, suggesting the patient had little tolerance of parent artery occlusion. Therefore, we tried to evacuate the thrombus without bleeding to avoid temporary occlusion of the MCA. The aneurysm wall over the thrombus was incised around the equator (Fig. 2C) and the distal hemisphere of the thrombus was detached (Fig. 2D). The intraaneurysmal thrombus was then shaved with the cavitron ultrasonic surgical aspirator (CUSA) without opening of the vessel lumen (Fig. 2E). The power of the CUSA was set to less than 20% of maximum. As the thrombus was shaved closer to the aneurysm neck, with reduction of the power of the CUSA to 10%, pulsation of the thrombus became prominent, so a temporary clip was applied to control bleeding for the last 2 minutes of the procedure. Although the MEP amplitude decreased during the temporary occlusion, direct neck clipping of the aneurysm was completed using multiple clips (Fig. 2F) and the MEP amplitude recovered after recirculation. The remainder of the thrombus was then totally removed. The sequence of the operative procedure is shown schematically in Fig. 2G.

Postoperative MR imaging revealed disappearance of the mass and edema in the left temporal lobe (Fig. 1C).

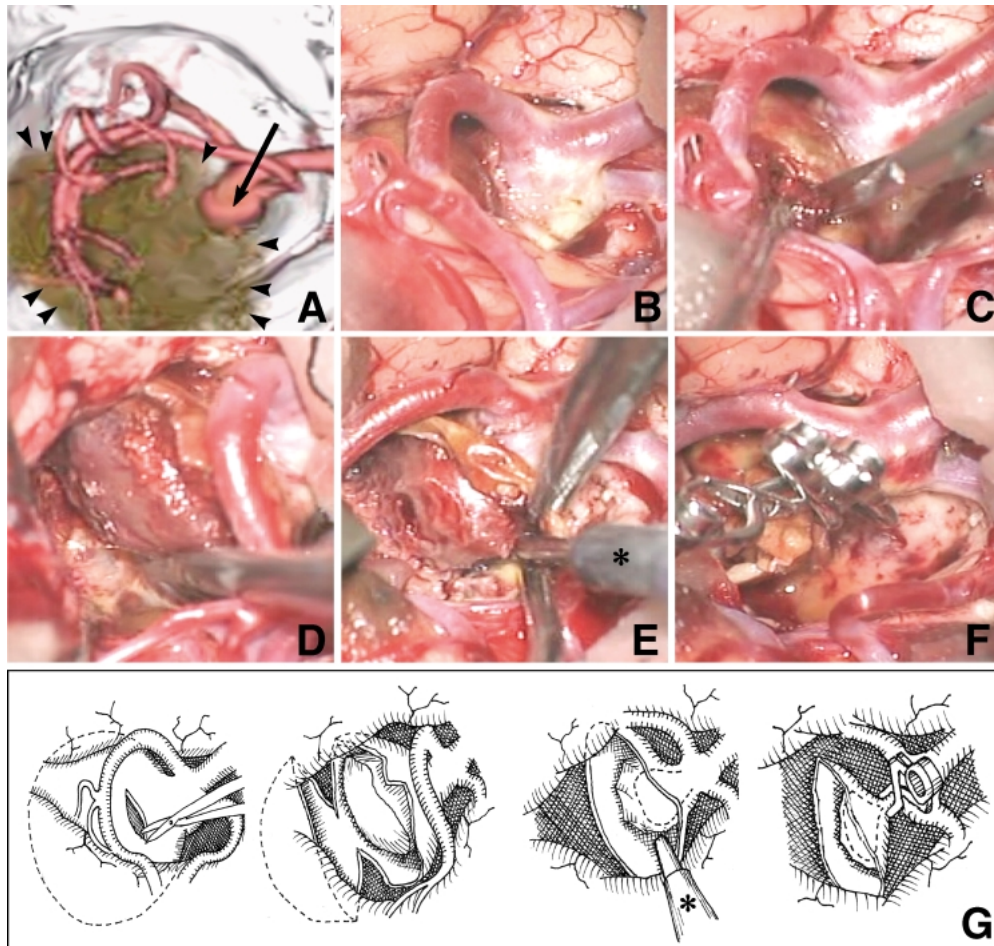


Fig. 2 A: Three-dimensional computed tomographic angiogram showing the aneurysm lumen of about 1 cm diameter (arrow) and the eccentric aneurysmal thrombus (arrowheads). B–F: Serial intraoperative microscopic views after dissection of the left middle cerebral artery showing the giant eccentric thrombosed aneurysm sac with a soft pink neck buried in the temporal lobe (B), the aneurysm wall over the thrombus incised around the equator (C), the thrombus after incision and separation before shaving (D) and after shaving with the ultrasonic aspirator (asterisk) around the neck without opening of the vessel lumen (E), and complete direct neck clipping of the aneurysm using multiple clips (F). G: Illustrations showing these operative procedures in sequence.

DSA showed successful clipping of the aneurysm and preservation of the branch of the left MCA (Fig. 1D). His symptoms gradually improved. He was discharged 3 weeks after the operation, and he became oriented with subnormal dementia score within one month.

Discussion

Eradication of thrombosed aneurysm by neck clipping depends on the volume, consistency, and location of the thrombus. Thrombosed aneurysms can be classified into six types on the basis of the thrombus and lumen morphology.⁴⁾ Direct neck clipping with or without thrombectomy is the best technique to treat thrombosed aneurysm (type 2), in which the thrombus is not circumferential around the aneurysm lumen and, more importantly, does not extend to or involve the aneurysm neck.⁴⁾ Since the thrombosed aneurysm was type 2 in the present case, we applied clips directly to the aneurysm neck. However, the clipping

was hindered by the large mass of the intraaneurysmal thrombus. Therefore, we attempted to remove the thrombus around the neck without occlusion of the MCA, since MEP monitoring suggested that even a short period of the MCA occlusion might elicit ischemic symptoms.

The ease of removal of aneurysmal thrombus depends on the consistency. Intraaneurysmal thrombus often consists of fresh clot and partially or totally organized thrombus. Intraaneurysmal clot was removed by bipolar coagulation and piecemeal resection until the introduction of ultrasonic aspiration into microsurgical usage. Therefore, volume reduction of the thrombus was time consuming, but continuous temporary clip application should be avoided. Therefore, removal of the thrombus without application of temporary clips was considered possible until brisk bleeding was encountered.⁶⁾ Recently, the CUSA has been widely used in microneurosurgery, particularly for the removal of tenaciously organized and laminated thrombus within the aneurysm sac, as even direct contact

of the CUSA probe with the aneurysm wall will not cause damage.^{1,2,5)} The present case shows that the CUSA can thin the intraaneurysmal thrombus enough to prevent interference with neck clipping without bleeding. Thrombus evacuation with the CUSA requires special attention to the power of the CUSA. The power of the aspiration and the vibration should be diminished meticulously with the thinning of the thrombus layer. Such adjustment of the power of the CUSA was essential in the present case.

The risk of embolism from the aneurysm should be considered without temporary occlusion of the parent artery. Furthermore, embolus emerging into the parent artery lumen cannot be removed without bleeding. Therefore, meticulous control of the CUSA power was also crucial to avoid displacing the thrombus into the parent arteries.

Intraoperative MEP in addition to somatosensory evoked potential monitoring is essential during surgery requiring temporary occlusion of the parent artery since patient tolerance cannot be evaluated before the operation.³⁾ In the present case, MEP monitoring showed that even short period obstruction of the MCA might cause ischemic morbidity during direct neck clipping, whereas the procedure of resecting the thrombus at the far side of the arterial lumen and ultrasonic shaving of thrombus toward the neck could be achieved without temporary clipping since there was no bleeding. Final clip application was possible without inducing parent artery ischemia.

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