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Case report

# A giant fusiform middle cerebral artery treated by low-flow superficial temporal artery bypass: A case report☆,☆☆,★,★★,†,††,†

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ABSTRACT

A giant fusiform aneurysm of the middle cerebral artery is a disease that causes many difficulties for endovascular intervention as well as surgery. No 1 solution is optimal for all cases, however for post-bifurcation aneurysms, trapping the aneurysms with a reanastomosis reimplantation, an in situ side to side bypass is feasible and has good results. We reported a 28-year-old male patient, admitted to the hospital because of severe headache, Glasgow Coma Scale 13 points, left hemiplegia, was diagnosed with subarachnoid hemorrhage due to rupture of a giant fusiform aneurysm of the middle cerebral artery in the M2 segment, Hunt and Hess grade 4. The patient underwent microsurgery with clipping aneurysm combined with a low-flow technique connecting the superficial temporal artery to the middle

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cerebral artery. Our findings suggest that surgery to connect the superficial temporal artery to the M2 segment and at the same time obstructing the parent artery occlusion of selected giant MCA aneurysm is an option to consider



## Introduction

Intracranial fusiform aneurysms are rare, but in recent years have had an increasing trend, mainly in young patients. A giant fusiform aneurysm is defined as an aneurysm larger than 2.5 cm. The most common location of aneurysms is in the middle cerebral artery and is discovered incidentally, however, more than 50% of patients have aneurysms rupture and over 60% die within 2 years [1]. Despite surgery, however, mortality and disability rates are still high, around 20%-50% in recent years [2]. Currently, the treatment of microsurgical clipping or endovascular coiling remains a challenge for physicians [3,4]. We want to share a clinical case using microsurgery clipping combined with a low-flow technique connecting the superficial temporal artery to the middle cerebral artery to treat a giant fusiform aneurysm of the middle cerebral artery in the M2 segment who had the complication of subarachnoid hemorrhage.

## Case description

A 28-year-old male patient was admitted to a stroke center near 4 months ago, with the most severe headache of his life in the right temporal-parietal position. Patient'condition at hospital admission with a Glasgow Coma Scale of 14 points (E4V4M6), no motor paralysis, no paralysis of cranial nerves, moderate headache. After 7 hours of admission, the patient had a disorder of consciousness, Glasgow 13 points (E4V4M5), left hemiplegia 4/5, severe headache, Hunt and Hess scores of 4, heart rate 40 times/min with sinus rhythm, the patient was consulted with a cardiologist to diagnose sinus bradycardia, treated with atropine 0.5 mg intravenously after 5 minutes, on an electrocardiogram, the sinus rhythm was 66 times/minute and maintained a stable rhythm. The patient underwent computed tomography of brain and cerebral vessels, with diffuse subarachnoid hemorrhage on both sides of the cerebral hemisphere due to the rupture of a giant 25mm x 11mm aneurysm of the right middle cerebral artery in the M2 segment (Fig. 1). The patient had a consultation with an interventional radiologist and a surgeon and agreed on microsurgery to treat emergency brain aneurysms.

## Surgery description

The surgeon used the right pterional incision, dissecting the right superficial temporal artery (STA), revealing 2 superficial temporal branches: the frontal and parietal branches, exposing to the root of the superficial temporal artery above the cheekbone arc, The superficial temporal artery at the base is 2 mm in size, take a segment over 8cm long. Dissection of muscle fascia, connective organization around the superficial temporal branch. Pumping and cleaning the lumen of the superficial temporal artery with water with heparin, creating an anastomosis of the superficial temporal artery: making an anastomosis in the shape of a fish mouth. Open the temporal frontal bone cap, open the dura, expose the right Sylvian cleft, dissect to the base of the skull, open the cerebrospinal fluid cistern on the cranial nerve II, aspirate the cerebrospinal fluid, expose the right internal carotid artery. From the right internal carotid artery exposed up to the junction, continue to widen the Sylvian cleft, reveal the branches of the middle cerebral artery segment M3, M2, see 2 branches of the right M2 artery separating behind the cerebral aneurysm. Dissection below the aneurysm showed intracerebral hematoma, about 20 cc hematoma, the hematoma was removed to reduce intracranial pressure, and for easy dissection. Dissection around the aneurysm showed that the aneurysm was very thin and had a breakpoint on the wall. Temporarily clamp the cerebral artery between the original M1 and M2 segments posterior to the aneurysm. Dissect the wall of the M2 artery and verify that a suitable segment of the artery for anastomosis lies anterior to the M2 temporal artery junction before dividing the 2 M3 branches. Open the M2 artery wall, proceed to anastomosis M2 and STA with separate sutures. Temporarily opening the clamp of the M2 artery posterior to the anastomosis shows the flow passing through the anastomosis into the superficial temporal artery, temporarily opening the clamp of the superficial temporal artery shows the flow from the superficial temporal artery passing through the anastomosis into the M2. A permanent clip was applied anteriorly and posteriorly to the aneurysm to completely exclude the aneurysm from the circulation. After surgery, the patient was sedated on a ventilator, 6 days later, the patient was tracheostomy and weaned from the ventilator. Eleven days later, the patient had a Glasgow Score Scale of 14 points (E4V5M4), left hemiplegia with 4/5 muscle weakness, the patient breathed spontaneously through a T-tube tracheostomy with oxygen 3 liters/min, clinically stable. Patients are trained to restore respiratory and motor function during treatment. 2 weeks later, a CT scan of the brain was taken (Fig. 2), clinically stable, the patient was removed from the tracheostomy and transferred to the Rehabilitation Center for further motor rehabilitation.

## Discussion

The treatment of giant aneurysms of the middle cerebral artery can now be accomplished by an endovascular tech-

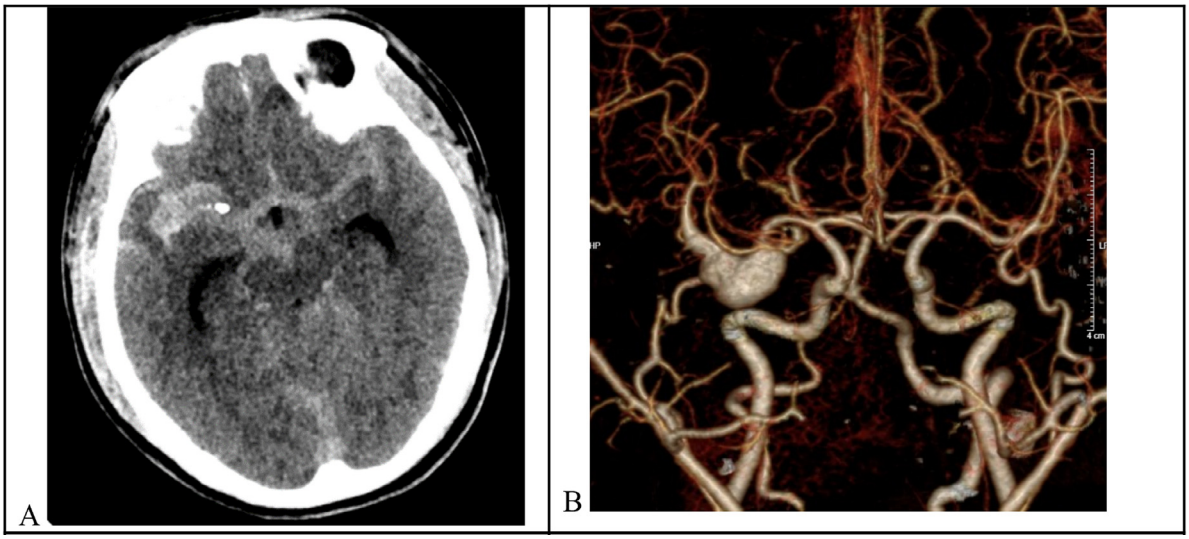


**Fig. 1 – Computed tomography image of the brain, brain vessels at hospital admission**

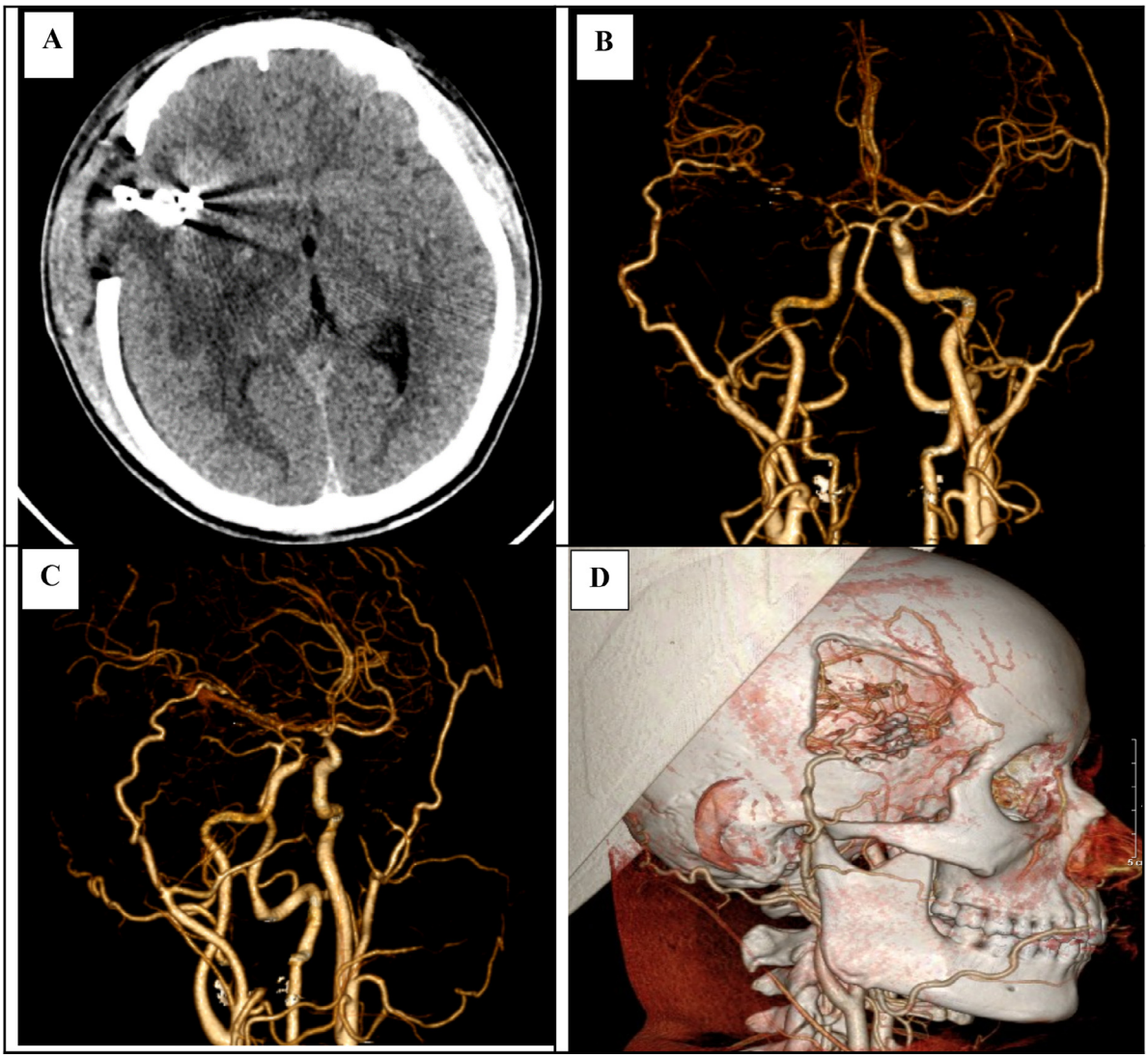


**Fig. 2 – Brain images after surgery**

nique that Huang recently demonstrated using the coil to treat giant or fusiform aneurysms on the M2 segment allowed a complete cure [2]. However, this method has not yet completely occluded the aneurysm and has complications related to the procedure. In our case, an endovascular treatment strategy would have been possible by occluding the mother vessel. Because the artery diameter was large, we do not believe an endovascular reconstructive procedure utilizing a stent would be a viable option. Implantation of a flow diverter would have carried, a high risk of hemorrhagic complications due to the necessary administration of dual antiplatelet therapy, while our patient's giant aneurysm ruptured and caused bleeding not only subarachnoid but also parenchymal bleeding, causing mass effect, this is similar to the report of Bartos [5], According to author Huang [2], out of 11 patients with giant MCA aneurysm, only 2 patients location of aneurysm segment M1, in which only 1 patient with a fusiform aneurysm received stenting and coiling, but the outcome was very bad with mRS score 5.0.

Therefore, the surgical method, which has been performed for more than 40 years, is still a radical treatment method, especially for giant aneurysms in the M2 segment [6,8]. A wide variety of bypass techniques for MCA aneurysms exist because they are so amenable to both traditional extracranial-to-intracranial (EC-IC) bypasses, such as superficial temporal artery (STA) bypass and high-flow interpositional bypass to the cervical carotid artery and reconstructive IC-IC bypasses, such as the end-to-end reanastomosis and the double-reimplantation technique [7]. Usually, for cases of ruptured post-bifurcation MCA aneurysms, it is simpler to perform a direct STA-MCA M4 bypass, utilize a superficial MCA branch as a means of preserving perfusion of the mother vessel territory, or they suggest trapping the aneurysm with a reanastomosis, reimplantation, an in situ side-to-side bypass or an interposed graft. Only in cases of distal insular aneurysms as a last resort, do they suggest performing a low flow STA-MCA bypass followed by proximal occlusion of the MCA mother vessel [5]. Our patient had a subarachnoid hemorrhage and therefore needed emergency surgery, which prevented the surgeon from having enough time to prepare for surgery.

During the operation, our patient had a lot of cerebral edema, so we removed the bone volet to create a window for the brain to escape. Author Bartos [5] also performed the same with patients with associated hematoma and cerebral edema. We encountered a lot of difficulties in the first case, the patient was admitted to the hospital when the aneurysm ruptured and the management of the rupture was very difficult due to the entire wall of the aneurysm being atherosclerotic and having many weaknesses. On the other hand, cerebral edema hinders and limits the operation of the surgeon. In this case, we performed clamping before and after the aneurysm, collecting hematoma in the brain, and stabilizing the anastomosis site before performing the anastomosis.

The authors suggested that direct anastomosis to restore circulation had good results, but intracranial and extracranial anastomosis (STA-MCA or internal carotid artery (IC) bypass) and external carotid artery (EC)) still plays a very important role because 1/ Meets blood flow needs, 2/ Simple surgery leads to reduced brain ischemic time, 3/ Difficulty in middle cerebral artery anatomy makes it difficult to make a direct bridge between the middle cerebral arteries, 4/ direct anastomosis of the right middle cerebral artery interferes with healthy vessels, increasing the risk of injury and ischemia and thereby aggravating the patient's condition [7]. Because of the above reasons, we chose the STA-MCA angioplasty method to ensure circulation, make the anastomosis quick and simple and not damage other branches of the middle cerebral artery in the context of a lying aneurysm, over a long segment of the middle cerebral artery and ruptured causing intracerebral bleeding.

Studies in the world also show that the results of angioplasty are very positive for giant middle cerebral aneurysms. Kivipelto's [9] study showed that the mortality rate was 4% in 24 patients studied for 14 years. Total aneurysm occlusion in all cases with a good outcome (GOS 4.5) is close to 90%. Our case has achieved very good results after 3 months of surgery with MRS 1.

## Conclusion

For patients with ruptured M2 middle cerebral artery giant fusiform aneurysm with a complication of subarachnoid hemorrhage, emergency surgery with STA-MCA bypass combined with occluding the mother vessel is a viable technique and effectively implemented.

## Patient Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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