



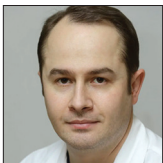
## Case Report

# Successful microsurgical clipping of ruptured fusiform aneurysm of the anterior cerebral artery. Case report and review of the literature

Revaz Dzhindzhikhadze<sup>1,2</sup>, Andrey Polyakov<sup>1</sup>, Oleg Dreval<sup>2</sup>, Valeriy Lazarev<sup>2</sup>

<sup>1</sup>Department of Neurosurgery, Moscow Regional Scientific Research Institute, <sup>2</sup>Department of Neurosurgery, Russian Medical Academy for Continuing Professional Education, Moscow, Russia.

E-mail: \*Revaz Dzhindzhikhadze - brainsurg77@gmail.com; Andrey Polyakov - ap.neurosurg@mail.ru; Oleg Dreval - odreval@nsi.ru; Valeriy Lazarev - vlazarev@nsi.ru



### \*Corresponding author:

Revaz Dzhindzhikhadze,  
Department of Neurosurgery,  
Moscow Regional Scientific  
Research Institute, Moscow,  
Russia.

brainsurg77@gmail.com

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## ABSTRACT

**Background:** Fusiform aneurysms (FA) of the anterior cerebral artery (ACA) are found rarely. The common clinical presentation is a subarachnoid hemorrhage (SAH). Surgery is the main treatment to prevent rebleeding.

**Case Description:** The authors present a case report of the ruptured FA of the ACA. The presented case demonstrates the successful microsurgical clipping of the fusiform ACA aneurysm.

**Conclusion:** A1-segment FA can lead to SAH with poor prognosis. The main goal of surgical treatment is to prevent rebleeding. Direct microsurgical clipping is one of the surgical options.

**Keywords:** Anterior cerebral artery, Fusiform aneurysm, Subarachnoid hemorrhage

## INTRODUCTION

Aneurysms of the proximal anterior cerebral artery (ACA) are quite rare, accounting for 0.7–1.4% of all intracranial aneurysms and 3–4% of ACA aneurysms.<sup>[2,3,6,24,28,33-35]</sup> The most frequent localization is the medial and distal regions of the A1-segment. Fusiform aneurysms (FA) account for about 1% of all the cerebral aneurysms and localized mainly in basilar, internal carotid, and middle cerebral artery, ACA accounts for about 1%.<sup>[1,2,4,10,16,17,21,24-26,35]</sup>

Dissecting FA of the anterior circulation are one of the causes of ischemic stroke and subarachnoid hemorrhage (SAH) among the young patients.<sup>[19,36]</sup> The etiology remains unknown, although there are certain risk factors, such as: trauma, moya-moya disease, fibromuscular dysplasia, and migraine. However, these risk factors do not always detect.<sup>[13]</sup> Surgery is the main treatment that prevents repeated hemorrhages. However, surgical treatment of dissecting FA of the A1-segment of the ACA is a difficult task. The choice of the timing and type of treatment depends on many factors: age, clinical condition, volume, and localization of hemorrhage.

We present a case report – successful microsurgical clipping of a ruptured dissecting FA in the A1-segment of ACA.

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## CASE PRESENTATION

Patient, 45-years-old female, was admitted in hospital on the next day after intracranial hemorrhage.

It is known that the onset of the disease was with a sudden headache, pain in cervico-occipital localization and rise of the arterial blood pressure up to 220 mm Hg. On admission to hospital a condition was critical, 11 Glasgow Coma Scale, Hunt-Hess 3 meningeal signs. The pupils are equal. Oculomotor dysfunction and visible paresis are not detected. The Babinsky signs on both sides.

Data on the previous infections, craniocerebral injuries and systemic connective tissue disorders are not detected.

Transcranial Doppler verified the rise of cerebral blood flow up to 220 cm/s.

Brain computed tomography (CT) scan and CT-angiography revealed the right sided FA on the A1-segment of ACA, basal SAH, intracerebral hematoma in the mediobasal frontal lobe and in the interhemispheric fissure [Figure 1]. Cerebral angiography performing was associated with a high risk of rebleeding and patient's condition worsening.

Because of a critical condition of the patient, we decided to treat the patient conservatively. The main protocol includes treatment of cerebral vasospasm and intracranial hypertension. This choice was explained by the possible need for trapping the A1-segment with revascularization, which could lead to worsen of the patient's condition and an unfavorable outcome.

After 12 days, when the patient condition was stabilized we performed a right-sided lateral supraorbital craniotomy, microsurgical clipping of the eccentrically FA on the A1 segment of ACA.

Traditional microneurosurgical technique was used. The aneurysmal dilatation occupied the distal part of the A1 segment. Along with fibrin masses in the area of the rupture the eccentrically fusiformed part of the aneurysm was visualized which was adhered to the optic nerve. In this case, the posterior wall of the artery was not changed. Aneurysm was dissected and clipped. There were no intraoperative complications.

The patient was extubated in the operating room and transferred to the intensive care unit. The postoperative period was uneventful. On the CT scan there are no postoperative complications.

Intraoperative photo and the CT scans of the brain in [Figure 2].

The patient was discharged without neurological deficit on the day 9<sup>th</sup> day after surgery.

## DISCUSSION

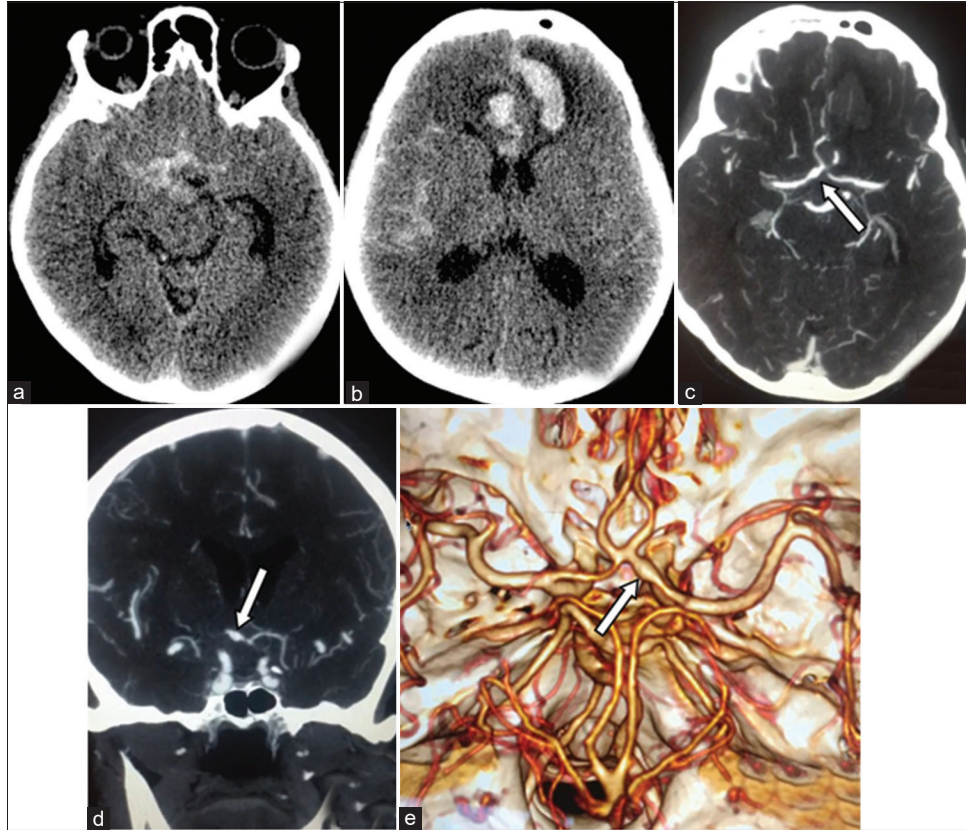
FA of the proximal ACA is a rare pathology. Only few cases are described in the literature.<sup>[1,2,4,9-11,16,17,21,24-26,35]</sup> It is known that the majority of FA located on ICA and basilar artery and associated with compression of cranial nerves or ischemia. For FA, on A1-segment of ACA intracranial hemorrhage is common and the main reason is arterial dissection.<sup>[22]</sup>

Surgical technics are controversial and depend on the size of the aneurysm and individual anatomy of circle of Willis. Clipping is the method of choice; however, the traditional technique is quite complicated due to the fusiform shape and high risk of intraoperative rupture. Clipping with a fenestrated clip can be used for affected segment; but the risk of damaging the perforating arteries and the recurrent artery of Heubner are high.<sup>[2]</sup> Preserving of all perforating arteries is not always possible and, in some cases, trapping can be done, with or without revascularization.<sup>[1,17,24,35]</sup> In some cases, aneurysm wrapping is used.<sup>[1,33,36]</sup>

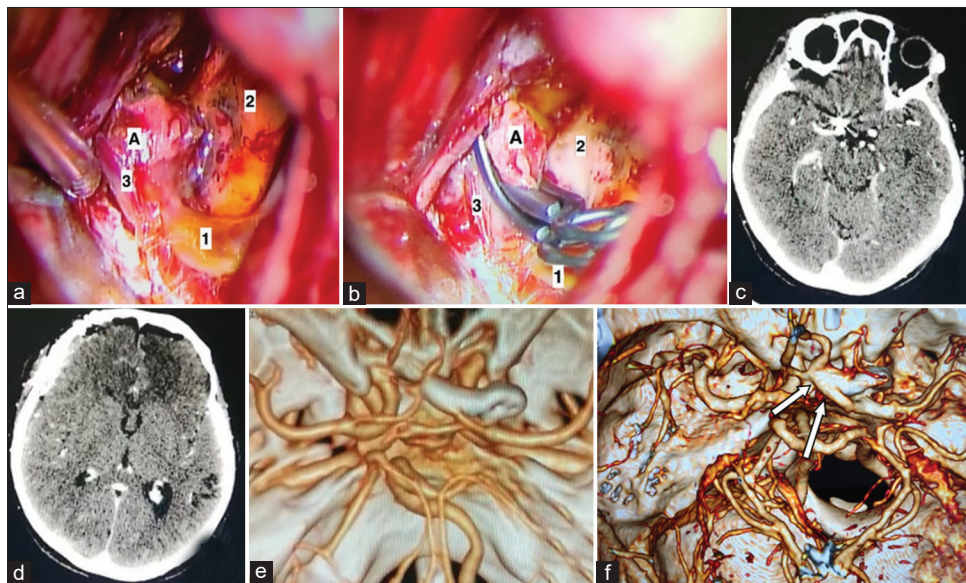
SAH due to ruptured dissecting aneurysm of anterior circulation is an infrequent pathology.<sup>[36]</sup> According to Ohkuma *et al.*, hemorrhage due to dissecting aneurysms of the anterior circulation is about 0,65% from all SAH.<sup>[19]</sup> In another series of dissecting aneurysms of ACA and MCA, 37% presented with hemorrhages, 56% with ischemia, and 8% with ischemia and hemorrhage.<sup>[13]</sup>

Mizutani *et al.* found that the destruction of the inner elastic membrane of the artery is the trigger of the development of dissection. At the time of damage of the membrane blood enters the vessel wall, forming a pseudo-lumen which causes an arterial stenosis. Thereafter, the blood flow can fall back into the true lumen, or into the layer between adventitia and media, which subsequently can cause SAH. The study also described that the vessel wall begins to restore from the 1<sup>st</sup> week of dissection and the reparative process lasts for about 4–5 weeks.<sup>[14]</sup>

It is not always possible to verify a dissecting aneurysm only according to cerebral angiography. One of the main signs is a double lumen, stenosis, and dilatation (“a pearl and a string symptom”), isolated stenosis (“a string symptom”), or occlusion.<sup>[12]</sup> Angiographic picture may vary depending on the morphology of the aneurysm and changes over time. T1-weighted images on magnetic resonance imaging (MRI) reveal an intramural hematoma in the early stages of dissection.<sup>[15,18]</sup> Sakima *et al.* also reported that the use of MRI in “Black-blood imaging” mode successfully reveals dissections of the ACA.<sup>[20]</sup> In difficult cases, when the source of hemorrhage cannot be accurately determined by angiography, subsequent angiograms with their careful study can indicate the initial signs of ACA dissection. According to some authors, the follow-up MRI, CT angiography or direct angiography should be performed within at least 1 month



**Figure 1:** (a and b) Native computed tomography (CT) scan. Subarachnoid-parenchymal hemorrhage associated with development of the intracerebral hematoma in the interhemispheric fissure and the left cortex. (c-e) CT-angiography. In the area of the A1-segment of the right anterior cerebral artery – is an extended fusiform aneurysm in the distal A1-segments (arrow); 6.6 mm in diameter at widest part of fusiform aneurysm and a length of about 10.4 mm.



**Figure 2:** (a and b) A microsurgical clipping stages of the eccentrically fusiform part of the aneurysm of the A1-segment of the right part of the anterior cerebral artery (ACA), (1) A1-segment of the ACA, (2) the right optic nerve, (3) the recurrent artery of Heubner, A - aneurysm. (c and d) Postoperative changes on native computed tomography (CT)-scan. (e and f) CT-angiography shows that the aneurysm was clipped. The ipsilateral A1 segment of the right ACA is conserved (arrows).



after SAH.<sup>[5,29]</sup> In our opinion, repeated CT angiography should be performed no later than 7–10 days after the initial examination.

Over the past two decades, there have been many reports of dissecting FA and SAH, which may be due to their inadequate diagnosis. For example, hypoplasia of the A1 segment can be regarded as dissection and such conclusion can occur with a frequency of up to 29%.<sup>[32]</sup> Inadequate diagnosis leads to delay in treatment, which increases the risk of repeated hemorrhage. Angiography results should always be correlated with the clinical condition and considering the localization of hemorrhage according to CT.

The main goal of the treatment is to prevent hemorrhage, which can be achieved by both open surgery and endovascular obliteration. In this example, the treatment consisted of microsurgical clipping. However, there are cases when direct clipping was insufficient and led to repeated hemorrhage.<sup>[30]</sup> Even though trapping and proximal occlusion of the main artery are the most effective methods of treating dissecting aneurysms, the anatomical complexity and structural variability of the proximal ACA and anterior communicating artery complex make these manipulations difficult. Some authors recommend bypass with superficial temporal artery or distal ACA side-by-side anastomosis.<sup>[7,8,23,27,30]</sup>

One of the treatment options is to use flow-diverting stents, but this is also not a safe procedure.<sup>[31]</sup> There are no recommendations about treatment of ruptured dissecting FA in proximal ACA and both options can be used, endovascular, or microsurgical. But with open surgery, direct visualization of critical perforating arteries is possible, which are difficult to visualize with endovascular technique. Since it is often difficult to accurately determine the morphological extent of dissection only by angiograms, microsurgical assessment of the arteries is crucial to determine the correct tactics for revascularization.

This clinical case demonstrates the importance of choosing the right treatment strategy in the form of determining the timing and type of surgery. Severe initial condition of the patient with massive subarachnoid-parenchymal hemorrhage on CT could lead to an unfavorable outcome. Hence, the strategy of surgical intervention in the delayed post rupture stage was chosen, which led to a favorable outcome. To determine the optimal strategy, a larger number of observations are needed with evaluation of follow-up data.

## CONCLUSION

Ruptured fusiform dissecting aneurysms of proximal ACA can cause severe intracranial hemorrhage and devastating consequences. The purpose of surgical treatment is to prevent repeated hemorrhage. In presented case, microsurgical clipping provided obliteration of the aneurysm and successful outcome.

## Declaration of patient consent

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

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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