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Case Report

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Coil Embolization of Traumatic Ophthalmic Artery Aneurysm: Case Report

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Conflict of Interest
The author has no financial conflicts of interest.

ABSTRACT

We describe the case of a 57-year-old man who had traumatic subarachnoid hemorrhage (SAH) with a delayed growth of an ophthalmic artery aneurysm. Initially, computed tomography angiography did not show any evidence of aneurysmal dilatation, but digital subtraction angiography (DSA) after 3 days showed small aneurysmal dilatation or dissection of a presumed lesion. Early intervention or surgery was difficult because of the patient's unstable condition. The SAH was completely resolved within 7 days. Follow-up DSA was performed 2 weeks later and it revealed an increasing size and shape change. We treated the patient with coil embolization, partially filling the aneurysm to save the ophthalmic artery. DSA performed 6 months later indicated that the aneurysm was completely embolized, sparing the ophthalmic artery. In traumatic SAH, delayed growth of the aneurysm should always be considered, and follow-up imaging should be performed. Partial embolization to save the ophthalmic artery can be one of the treatment modalities for selected patients.

Keywords: Head trauma; Aneurysm; Vascular system injuries

INTRODUCTION

Traumatic aneurysms are rare and represent less than 1% of all intracranial aneurysms. It occurs most commonly in the peripheral arteries or the internal carotid artery (ICA) in a closed head injury.[3,5,9-11,14] Traumatic ophthalmic artery aneurysms are particularly rare. We present a case of endovascular treatment of traumatic ophthalmic artery aneurysm which had grown late after closed head injury.

CASE REPORT

A 57-year-old male was transferred to emergency room presenting with stuporous consciousness after slip down on the floor. He had no medical history. The left occipital scalp was lacerated and swollen. The pupil size and light reflex were intact. Computed tomography (CT) scan revealed dense subarachnoid hemorrhage (SAH) along basal cistern without basal skull fracture including the optic canal (**FIGURE 1A**). To rule out SAH from spontaneous aneurysmal rupture CT angiography was performed and we could not find any evidence

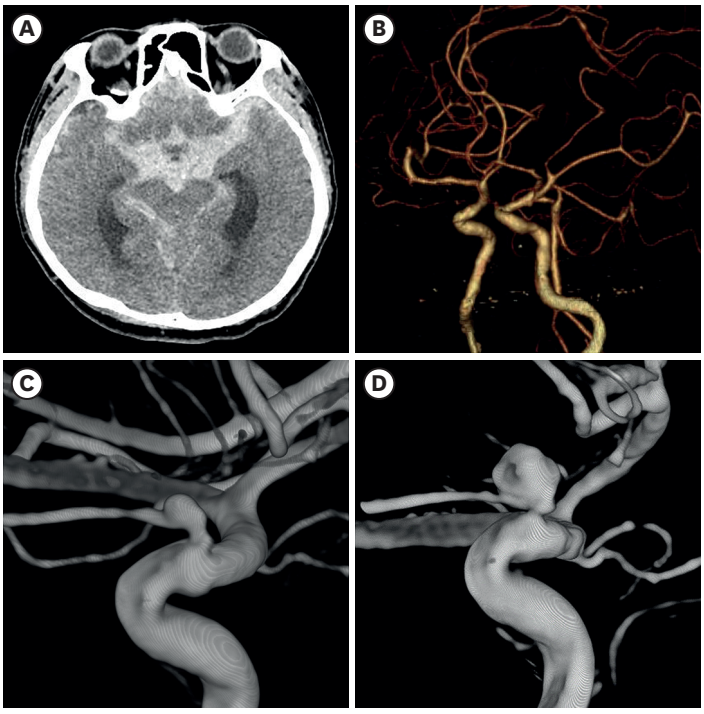

FIGURE 1. (A) Plain computed tomography scan which shows dense subarachnoid hemorrhage along basal cistern. (B) Initial CT angiography which shows no evidence of aneurysm or dissection. (C) Digital subtraction angiography reveals dissecting aneurysm originating from proximal opthalmic artery. (D) 5 mm size increased aneurysm on hospital day 14.

of vascular abnormality (**FIGURE 1B**). Because distribution of SAH was similar to that of aneurysmal rupture, digital subtraction angiography (DSA) on hospital day 4 revealed newly developed broad neck aneurysm on right proximal ophthalmic artery close to anterior clinoid process (**FIGURE 1C**).

Morphology and course of ICA was unremarkable. The developing region of aneurysmal dilatation began about 1mm apart from origin of ophthalmic artery. The author decided the aneurysm being unruptured state because it had not less likely to cause SAH from anatomical location. It located close to anterior clinoid process and dural ring in extradural region.

Endovascular treatment or surgical clipping was not done because of the patient's poor condition like pneumonia and sepsis. Follow up DSA was done 2 weeks after general condition had improved and revealed enlarged aneurysm mainly toward anterior and superior direction (**FIGURE 1D**). The patient's visual function was fair without neurological deficit. For coil embolization, a 6 Fr Envoy DA guiding catheter (Cordis Corporation, Miami Lakes, FL, USA) was advanced through 6 Fr femoral sheath under general anesthesia. A straight shaped SL-10 (Stryker Neurovascular, Freemont, CA, USA) microcatheter was positioned in the aneurysm posteriorly (**FIGURE 2A**). An Axium (Medtronic, Ervine, CA, USA) 3D coil was used to make frame (**FIGURE 2B**). Frame coil was not occupied in anterior and superior part of aneurysm to save opthalmic artery. Six packing coils were deployed in the frame, and the final anigography revealed partial stagnation of contrast near opthalmic artery (**FIGURE 1C & D**). After 6 months later follow up DSA revealed complete occlusion and no evidence of compaction or recurred aneurysm (**FIGURE 1E & F**).

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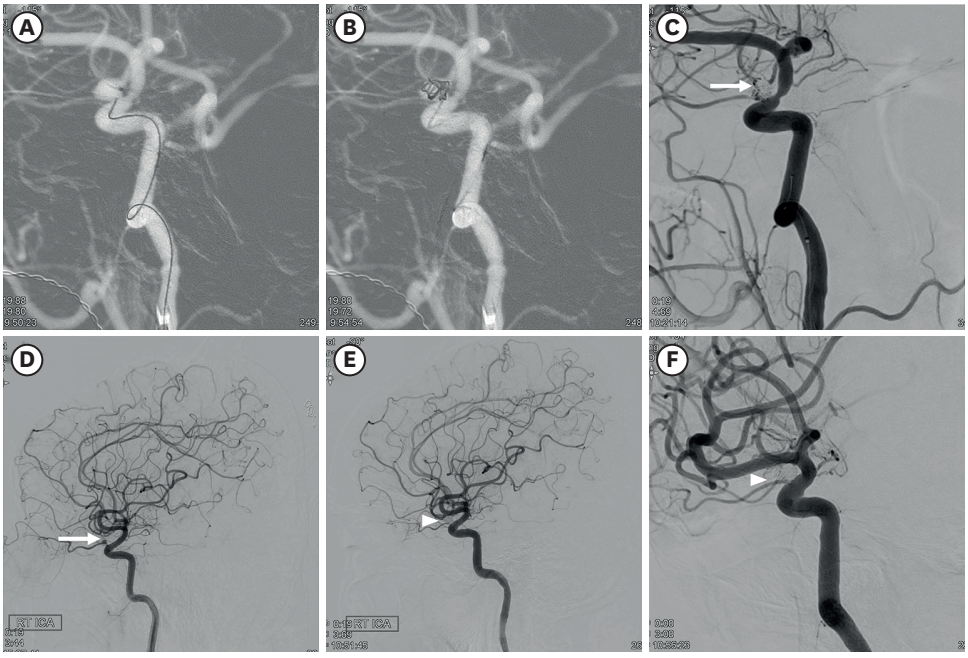

FIGURE 2. (A) Straight shape microcatheter positioned in posteriorly. (B) Frame coil that occupies aneurysm sparing the space proximal opthalmic artery comes from. (C, D) Final angiography reveals partial embolization (white arrow) of aneurysm to save opthalmic artery. (E, F) Digital subtraction angiography performed six months later revealed complete occlusion (arrowhead).

DISCUSSION

Natural history of traumatic aneurysm is not well known, but some authors presented that the most aneurysm rupture at the 2nd or 3rd week as growing after the first head trauma.[6,13] In our case, the aneurysm was not developed after head trauma, but had been grown to a size of 2 mm on hospital day 4 and to 5 mm on day 14. According to Kanazawa et al.,[8] the wall of a traumatic aneurysm is formed by adhesion of thick arachnoid and surrounding brain cortex without the development of a neck. Histologically it is the composition of the organized hematoma with fibrin admixed with white cell elements. It also has no normal vessel elements and resulting in a final diagnosis of a false aneurysm.

Blunt injury or penetrating injury is the main dynamic force, and the mechanism is closely related with the anatomic location of the injured vessel and surrounding hard structures. For example, most ICA injuries results from supraclinoid process, pericallosal artery injuries from falx cerebri, and middle cerebral artery injuries from sphenoid ridge.[1] In our case, the patient had hit direct contusion on occpital bone. The main dynamic force was caused by anterior clinoid process by inertia.

Mechanism of traumatic opthalmic artery aneurysm is not fully understood.[12] In anatomy, opthalmic artery originates from ICA, and runs through dural sheath on optic canal floor. Such complex vessel and bony structure make opthalmic artery different from anterior cerebral artery or middle cerebral artery. Stretching and tearing of the opthalmic artery at the dural penetrating point can lead to SAH. Minor tear of ICA wall and subsequent seal off by blood clot become recanalization and formation of false wall.[9]

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TABLE 1. Case reports of coil embolization treated traumatic opthalmic artery aneurysms

Authors (Year)	Visual function	Skull fracture	Embolization methods
Hopkins et al. (2007)[7]	Normal	Yes	Embolization
Vora et al. (2007)[14]	Abnormal	Unknown	Embolization
Kanazawa et al. (2011)[8]	Abnormal	Unknown	Embolization
Matsunaga et al. (2019)[10]	Abnormal	No	Partial embolization
Present case (2021)	Normal	No	Partial embolization

Dissecting aneurysm or blood blister like aneurysm can present dense SAH without evident aneurysmal dilatation on initial vascular imaging.[4,15] But the delayed developed aneurysm was completely isolated from ICA, and apart from the developing point of ophthalmic artery. Choi et al.[2] reported spontaneous fusiform ophthalmic artery aneurysm in intracanalicular segment, but it was different form this case.

Only parent artery occlusion is a perfect treatment in dissecting aneurysm or pseudoaneurysm. But in patients with normal visual function and patent opthalmic artery, treatment should focus on the two goals: the aneurysm obliteration to prevent rupture and complete save of opthalmic artery.

As far we know, 5 case reports have presented coil embolization as a good treatment in the traumatic opthalmic artery (**TABLE 1**). This is the only case which tried partial embolization and complete remodeling of opthalmic artery and pseudonaeurysm obliteration. Partial embolization sparing opthalmic artery can be a good treatment because aterial wall dissection begins form ICA-opthalmic artery. This also has advantages over open surgery in that has prolonged anesthesia time and rupture risk during anterior clinoid process drilling. Packing the weak parts and saving opthalmic artery has complete embolization like remodeling from flow diverters (**FIGURE 1F**).

CONCLUSION

Traumatic opthalmic artery aneurysm can be developed late after closed head trauma. In case with patent opthalmic artery, partial embolization saving opthalmic artery can be a good treatment choice.

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