ENDOVASCULAR TREATMENT OF TRAUMATIC ANEURYSM INVOLVING HEAD AND NECK REGION

Suthisak SUTHIPONGCHAI,M.D., Orasa CHAWALPARIT,M.D., Pipat CHIEWVIT,M.D., Anchalee CHUROJANA,M.D.

ABSTRACT

Endovascular treatments of 21 traumatic vascular diseases with intracranial aneurysms and aneurysms of head and neck are reported. Fourteen cases with epistaxis were treated by detachable balloon occlusion and thirteen cases of aneurysms were successfully occluded. Five of this group had associated carotid cavernous fistulas (CCF) and successfully occluded in four cases. One case of non-epitaxis had CCF with aneurysm of internal maxillary artery and was treated by Gelfoam embolization. Two cases of cervical internal carotid aneurysms were treated successfully in the same setting of associated CCF. The other two cases of cervical carotid and one of common carotid aneurysms were treated by surgery. One hemiplegia from thromboemboli and one blindness from unavoided occlusion of the ophthalmic origin were found as the complication.

Key Words : Traumatic aneurysm; head and neck; endovascular treatment.

Traumatic processes of vessels could bring about either hemorrhage, thrombosis, fistula or aneurysm.

Traumatic aneurysms are not uncommon; most of them involve the large basal arteries. The assumption of a traumatic origin is usually based on the close temporal injury and local relationship between a head injury and the later manifestation of the aneurysm.

The treatments of the aneurysms depend on location and size of the lesion. Herein we report our experiences in treatment of the various locations and sizes of the traumatic aneurysms in the head and neck region by endovascular approaches.

MATERIALS AND METHODS

From 1992 to1996, twenty-one cases came to our department for endovascular treatment of the traumatic vascular diseases associated with aneurysm. There were 16 males and 5 females with the range of age from 16 to 60 years old. Nineteen patients had a history of car accident and two had had previous head injury from other causes. Of all patients, 14 patients presented with epitaxis mostly moderate to severe degree. The first episode of epitaxis occured within 5 days to 6 months after injury. The other 7 cases without epitaxis came with sign and symptom of the carotid-cavernous fistula and aneurysms were incidental findings.

Four cases had two aneurysms and all had history of epitaxis. In the group of patients with epitaxis, 18 aneurysms were found and 5 cases

Neuroradiology Section,Diagnostic Division, Department of Radiology, Siriraj Hospital,Faculty of Medicine, Mahidol University, Bangkok, Thailand.

were associated with carotid-cavernous fistula (CCF). The location of the aneurysms are shown in Table I.

In 7 cases without epitaxis, all were diagnosed clinically to be CCF and angiographically proven to have the fistula. The location of the aneurysms are shown in Table II.

ENDOVASCULAR TREATMENTS

The angiographic examination includes four-vessels and bilateral external carotid angiography to exclude additional vascular lesion, appropiate views of the aneurysms and a cross-compression study to assess the competency of the circle of Willis. Embolization is done at the same or the second setting under neuroleptic analgesia with anesthesist in attendance. A thin-walled No.7 or 8 French introducer catheter (Ingenor) is placed in the involved internal carotid artery by transfemoral approach. Continuous perfusion of the introducer catheter is done by heparinized saline. Systemic heparinization is administered by using 3000-4000 units of heparin intravenously before introducing of the balloon.

Gold valve balloon No.9 (If only CCF is found) or No.16 (If associated or only aneurysm of the cavernous portion is found) is used to occlude the CCF and/or the neck of the aneurysm. In the case of aneurysm in cavernous portion, sacrifice of the internal carotid artery is usually the aim. Once the balloon is inflated, the internal carotid artery is arbitrarily occluded for 15-20 minutes under careful clinical monitoring to detect any neurological deficit. In occlusion of the artery, if the patient cannot tolerate, the balloon should be deflated immediately. When tolerance test is successful, sacrifice of the internal carotid artery is done at the cavernous portion with occlusion of the fistula and aneurysmal neck. The stumpectomy of the sacrificed artery is followed by using No.16 GVB at the origin just above the bifurcation. Heparinization is reversed after embolization is completed.

Particulate embolic material such as Gelfoam or Ivalon is used for embolization of the small aneurysm of external carotid artery. There is only one case in our series which is an aneurysm of internal maxillary artery and we used Gelfoam to occlude the aneurysm.

Surgery is the first choice for the treatment of false aneurysm in the cervical portion if it is not occluded in the balloon embolization for treatment of CCF.

RESULTS

In epitaxis group, 14 of 21 patients, sacrifice of the involved internal carotid artery with successful controlling of the bleeding were successfully treated by endovascular mean in 13 out of 14 patients. Ten cases were treated sucessfully in the first setting of embolizaiton. Of the other 3 cases, one with CCF and aneurysm at the cavernous portion, the internal carotid was first sacrificed with 4 more balloons in the aneurysm. The angiogram after 3 months follow up showed filling of the aneurysm. In 8 months follow up angiogram, no aneurysm is seen.

Another case with aneurysm at the cavernous portion was first occluded only the aneurysm neck. Follow up study showed recurrent aneurysm with the first balloon displacement into the aneurysm, so we sacrificed the internal carotid artery in the second setting.

The third case of epitaxis group with two aneurysms at the cavernous part, the internal carotid artery was sacrificed in the first setting but the smaller aneurysm was still seen. After 10 days follow up, no more filling of the aneurysm was shown.

The last patient with severe head injury and carotid-cavernous fistula had one aneurysm at the supraclinoid portion and one at the cavernous portion. The supraclinoid aneurysm was trapped by surgery. Balloon embolization was tried to occlude the internal carotid artery but the balloon was ruptured possibly from bony spicule. The patient had severe epitaxis after the procedure. So emergency ligation of the artery was done by the surgeon.

In the non-epitaxis group,2 of the 4 cervical internal carotid aneurysm, the artery was sacrificed in the same setting for the treatment of the CCF. The other two cervical aneurysms were treated by surgery. One case with common carotid aneurysm at the same site as the CCF, the internal carotid artery was sacrificed for treatment of the CCF. The aneurysm was treated by surgery. Another case of CCF with aneurysm at the anterior choroidal artery was treated only the CCF. The anterior choroidal aneurysm is small and is referred to the surgeon.

The patient with internal maxillary aneurysm was embolized by Gelfoam via 5 French catheter and well occluded.

All patients whose internal carotid arteries were sacrificed have tolerated such occlusion. In one case with supraclinoid aneurysm and severe epitaxis, the ipsilateral eye is blind after the internal carotid artery was sacrificed. One case with CCF and cavernous portion of internal carotid aneurysm has hemiplegia after the treatment, possibly from thrombus emboli to the middle cerebral artery. The other cases have no severe complication.

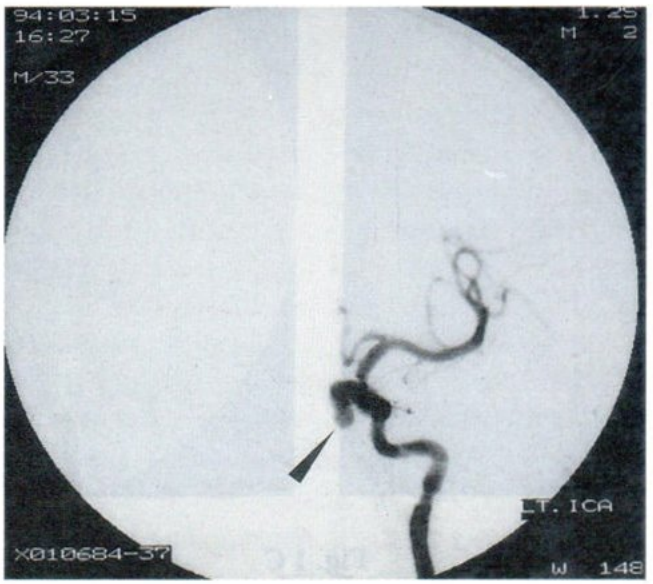

Fig. 1 A

Fig. 1 Traumatic aneurysm of cavernous portion of left internal carotid artery (arrow in A.).

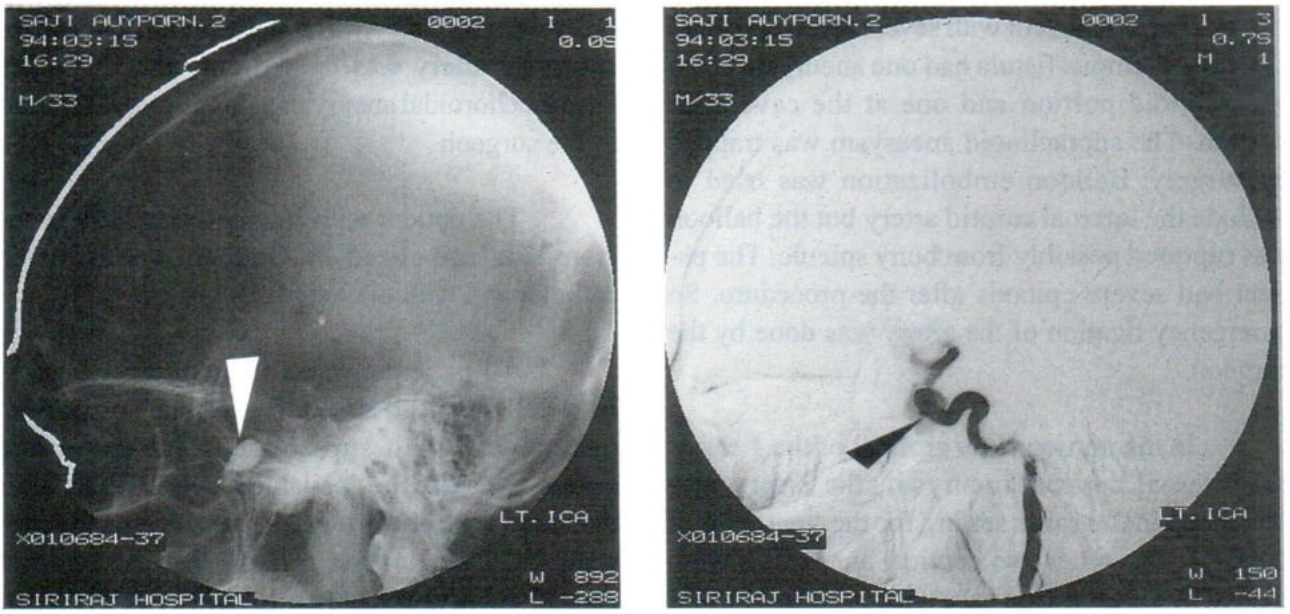

Fig. 1 B

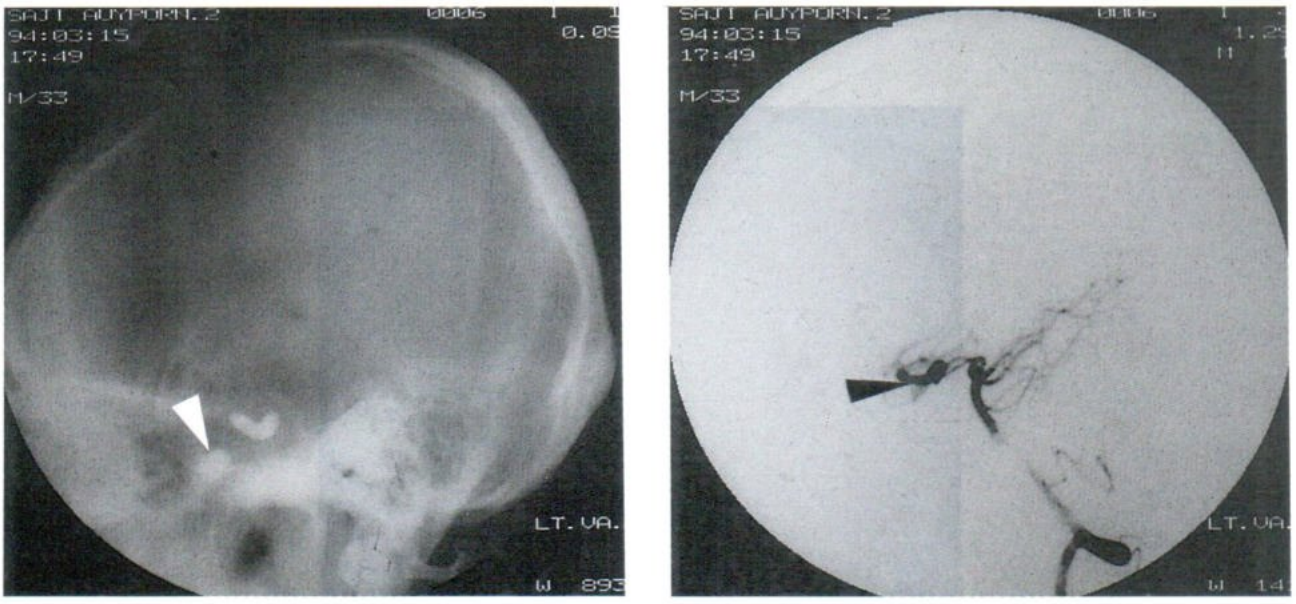

Fig. 1 C

Fig. 2 The first balloon was placed at the aneurysm neck but displaced into the aneurysm (B). Sacrificed left ICA. was done (C).

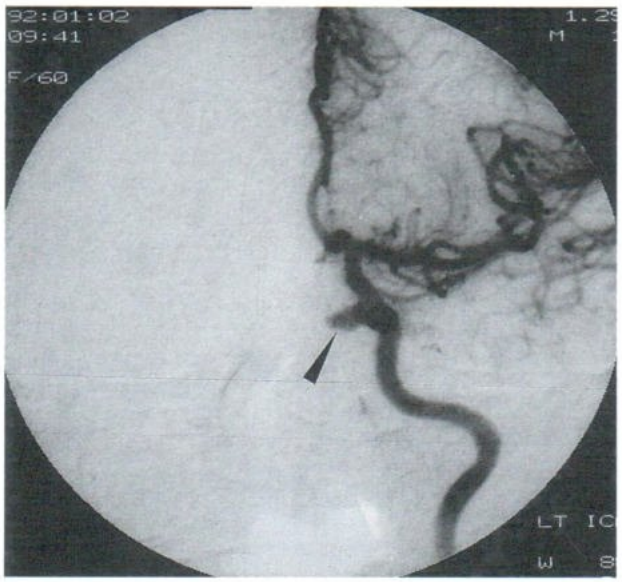

Fig. 2 A

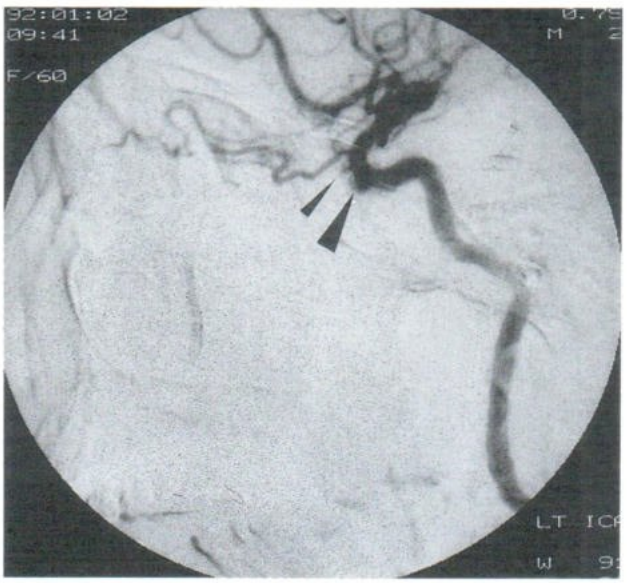

Fig. 2 B

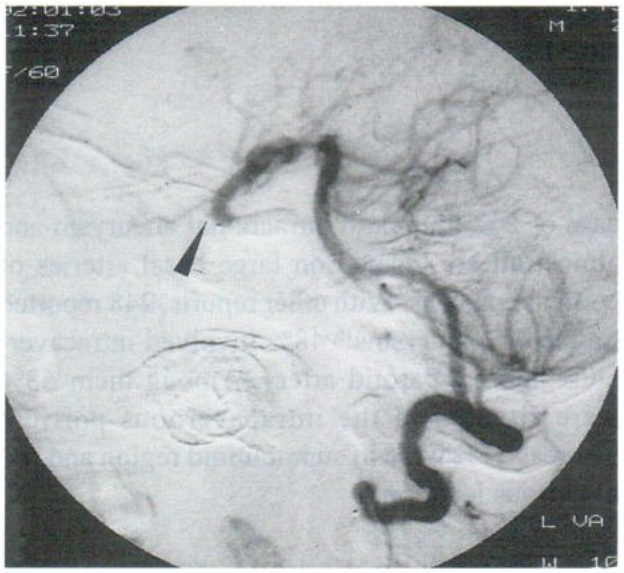

Fig. 2 C

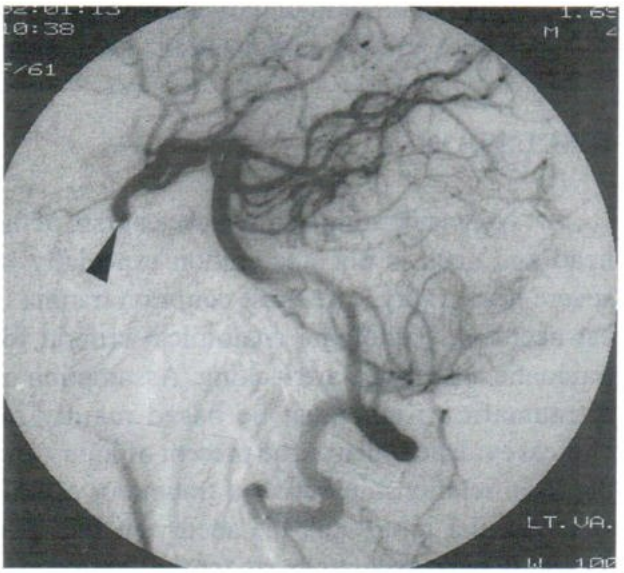

Fig. 2 D

Fig. 2 Two traumatic aneurysm of cavernous portion of left ICA. (arrows in A and B). After sacrificed left ICA, the smaller aneurysm was still seen (arrow in C) . Following up angiogram shows no more aneurysm (D).

Fig. 3 A

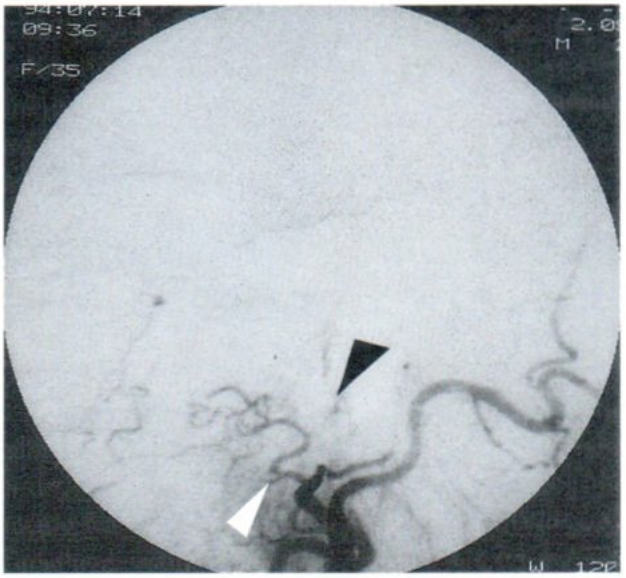

Fig. 3 B

Fig. 3 Right internal maxillary aneurysms (arrows in A). After Gelfoam embolization, no more aneurysm (B).

DISCUSSION

Nonpenetrating traumatic aneurysm of the head and neck is not uncommon especially in severe head injury. The most common trauma is car accident. Pathologic anatomical criteria for traumatic aneurysms are lacking. Assumption of a traumatic origin must be based mainly on clinical evidence such as the present of injury and the local relationship between trauma or associated vascular injury and the aneurysm site. The patient may be asymptomatic for the aneurysm if it is not ruptured especially at the area out side the skull base or cranium such as cervical region. However, in the case of skull base fracture, severe vascular injury does often occur, and the cavernous portion of the internal carotid artery is the most vulnerable to injury. Since the anatomical small space and close relationship to the bone around the cavernous sinus, injury to the vessel by bony spicule or fragment is usually severe. These patients are all symptomatic. Fox[7] listed the case of 242 traumatic intracranial aneurysm and almost all are located on large basal arteries or cortical branches. With other reports, 248 reported traumatic aneurysms[16] 48% involved intracavernous internal carotid artery. Among them 63% were situated in the intracavernous portion, whereas 31% were in supraclinoid region and 6% of petrous location.

Most traumatic intracavernous internal carotid aneurysms present with rupture into the sphenoid sinus had medial tear.[2,9,14,17] In our cases, we have one case of supraclinoid internal carotid and two cases of ophthalmic aneurysms ruptured into the sphenoid sinus as well. All of these cases had history of epitaxis usually delayed and gradually severe in later episodes. The mortality of this condition is 30-50%.[17] The classical triad of unilateral blindness, orbital fractures and massive epitaxis may alert the surgeon to the present of

pseudoaneurysm and emergency treatment may be needed.[9] The mortality rate and recurrent hemorrhage for surgical treatment are still high in most reports.[4,8,14,18] Recent series reported better outcomes of balloon embolization.[1,6,10] Scattered case reports also showed application of the technique in other traumatic aneurysms presenting epitaxis.[15,2,9] In our experiences, balloon occlusion can be easily and readily accomplished under local anesthesia with neurological status continuously monitored. The aneurysm at neck has to be occluded in the arterial side to avoid recurrent opening. Since the fragile aneurysmal wall, the balloon should be aware of propagation into the sac. Sacrificed main artery is suggested. When the internal carotid artery must be sacrificed,[6] the GVB No.16 is recommended because of its elongated shape. The balloon should be placed and occlude the opening of the aneurysm and the entire cavernous segment, there by controlling the branches of C_4 and C_5 segments of the artery which represents the source of recanalization the thrombosed segment.[11] The other balloon for stumpectomy is needed to prevent thrombus embli retrogradely slipping to the supraclinoid cerebral arteries.

Y. Masana[12] reviewed and reported 10 cases of CCF associated with aneurysms. He found correlated ratio of location of the aneurysms with that of aneurysms without CCF. In his report, only direct surgical approach was successful in completely obliterating the CCF and aneurysms. In our 5 patients of cavernous internal carotid aneurysms with CCF. had epitaxis. Four of them were successfully treated with detachable balloon. The last one is the one we tried to sacrificed the artery but ruptured balloon occured and the patient was emergency ligated the artery (as described above). We still recommended that the treatment of choice for such case is detachable balloon occlusion. Both CCF. and aneurysm can be occluded in the same setting. Only one of our five cases had partial occlusion of the aneurysm. Delayed thrombosis and disappearance of the aneurysm was noted after follow up angiogram. Decreasing flow or partial occlusion is also gives some benefit.[1]

Treatment of choice of the cervical carotid aneurysm may be surgery. We try to keep the internal carotid artery for treatment of CCF. and leave the aneurysm for the surgeon. The aneurysm is occluded only in the case that sacrifice of the internal carotid artery for CCF cannot be avoided.

Small aneurysm of the external carotid branches can be treated by many ways such as particulate embolic material and histoacryl. Because of anatomical anastomosis of internal and external carotid system, the particle should not be smaller than 100 um. In our case, we used handcut Gelfoam and injected through the 4-F catheter. The aneurysm was occluded successfully with no complication.

Complications associated with endovascular treatment do occur and are primarily related to distal emboli, either thromboemboli or unwanted embolization of the normal cerebral artery and subsequent strokes. The risk of the procedure is largely related to the careful approach, adequate heparinization, and knowledge of the anatomical vessels and used instruments. One of our cases had hemiplegia possible from thromboemboli. The other one had blindness which could not be avoided because of the near ophthalmic origin of the supraclinoid aneurysm. In order to stop bleeding of severe epitaxis and save the patient life, we had to place the balloon and occlude the ophthalmic origin. In some of our cases which the aneurysm is near the ophthalmic artery, if the artery also has the blood supply from external-carotid system, the vision can be spared.

With the experiences of these cases, we can conclude that endovascular treatment is indicated in traumatic aneurysms of head and neck especially in the area that surgical approach is difficult such as base of skull. Urgent treatment is

needed in the case with epitaxis and detachable balloon occlusion to sacrifice the internal carotid artery and aneurysm is recommended.

Table I (A) Site of aneurysms in epitaxis (aneurysm/case)

	No CCF	With CCF
Cavernous ICA	9/7	5/5
Supraclinoid ICA	1/1	1/1
Opthalmic	2/2	-
Total	12/10	6/6

NB : ICA = Internal carotid artery
ICA = Carotid - cavernous fistula
Four cases with two aneurysms in each patient.

Table I (B) Site of aneurysms in 4 cases with double aneurysms

Case I	:	2 aneurysms at cavernous ICA.
Case II	:	2 aneurysms at cavernous ICA,
Cases III	:	1 aneurysm at cavernous ICA, 1 at supraclinoid ICA.
Cases IV	:	1 aneurysm at cavernous ICA, 1 at ophthalmic origin

Table II Site of aneurysms in nonepitaxis (case)

Cervical ICA	4
Common CA	1
Anterior choroidal	1
Internal maxillary	1

ICA = Internal carotid artery.

Table III Treatment of aneurysms in epitaxis.

Sacrificed ICA	13
Surgery	1

Table IV Treatment of nonepitaxis

Detachable balloon occlusion (Sacrificed ICA)	2	(Cervical ICA)
Gelfoam	1	(IMA)
Surgery	4	

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