

ASYMPTOMATIC, UNRUPTURED CAROTID-OPHTHALMIC ARTERY ANEURYSMS: ANGIOGRAPHICAL DIFFERENTIATION OF EACH TYPE, OPERATIVE RESULTS, AND INDICATIONS

Yoshiaki Kumon, M.D., Saburo Sakaki, M.D., Kanehisa Kohno, M.D.,
Shinsuke Ohta, M.D., Shiroh Ohue, M.D., and Yoshihisa Oka, M.D.

Department of Neurological Surgery, Ehime University School of Medicine, Ehime, Japan

Kumon Y, Sakaki S, Kohno K, Ohta S, Ohue S, Oka Y. Asymptomatic, unruptured carotid-ophthalmic artery aneurysms: angiographical differentiation of each type, operative results, and indications. *Surg Neurol* 1997;48:465-72.

BACKGROUND

Some types of carotid-ophthalmic artery aneurysms are still difficult to clip successfully because their exposure requires opening the cavernous sinus and/or retracting the optic nerve. It is useful to know the complications and to determine the type of aneurysm preoperatively for the management of carotid-ophthalmic artery aneurysms.

METHODS

The operative results in 15 patients with asymptomatic unruptured carotid-ophthalmic artery aneurysms were surveyed. The aneurysms were small in all the patients, and they underwent direct operation. Four patients presented with other ruptured aneurysms, four with other diseases (infarction, trauma, or pituitary adenoma), and seven were evaluated with magnetic resonance angiography for symptoms such as vertigo or headache. Among them, five had carotid cave aneurysms and one had paraclinoid aneurysm.

RESULTS

Neck clipping was performed in 13 patients. Postoperatively, ipsilateral visual loss was encountered in one patient, and ipsilateral visual field defect was encountered in three patients. The visual field defect was lower nasal quadrant hemianopsia in two patients and lower hemianopsia in one patient. The cause of this complication was suspected to be retraction and/or the heat of the drill near the optic nerve. It seemed to be possible to distinguish the carotid cave or the paraclinoid aneurysm from the other carotid-ophthalmic aneurysms using carotid angiography preoperatively.

CONCLUSION

When direct operation is performed for a carotid-ophthalmic artery aneurysm, care must be taken to avoid

optic nerve injury caused by the retraction and/or the heat of the drill. © 1997 by Elsevier Science Inc.

KEY WORDS

Carotid-ophthalmic artery aneurysm, unruptured aneurysm, operation, carotid cave aneurysm, paraclinoid aneurysm.

We have recently detected many asymptomatic, unruptured aneurysms with magnetic resonance (MR) angiography performed as examinations for other diseases. We usually operate on these aneurysms directly to prevent fatal subarachnoid hemorrhage.

Direct surgical therapy for carotid-ophthalmic artery aneurysms was associated with an unusually high mortality and morbidity in the past [5,7,10]. With the development and refinement of microsurgical techniques, however, the risks associated with direct surgical therapy have been minimized, and successful treatment of these aneurysms has become attainable [1,2,4,8,13]. Some types of carotid-ophthalmic artery aneurysms, such as carotid cave and paraclinoid aneurysms, are still difficult to find and clip successfully because they are located partially in the cavernous sinus. They require removing the anterior clinoid process and the roof of the optic canal, opening the cavernous sinus, and retracting the optic nerve. The other types of carotid-ophthalmic artery aneurysms are easy to find intraoperatively, but in some cases, they also must be surgically treated with the same procedure. Postoperative complications such as visual disturbance are reported to occur more frequently than with other aneurysms.

We report herein the operative results in 15 pa-

Address correspondence to: Yoshiaki Kumon, M.D., Department of Neurosurgery, Ehime University School of Medicine, Shigenobu-cho, Onsen-gun, Ehime 791-02, Japan.

Received July 2, 1996; accepted January 27, 1997.

tients with asymptomatic, unruptured carotid-ophthalmic artery aneurysms, and we discuss the feasibility of detection of various aneurysmal types using preoperative carotid angiography.

PATIENTS AND METHODS

PATIENT POPULATION

During the past 10 years, 18 patients with carotid-ophthalmic artery aneurysms have been treated with direct surgery in our clinic. Among them, 15 patients had asymptomatic unruptured aneurysms. Four patients presented with other ruptured aneurysms, four presented with other diseases (cerebral infarction, trauma, or pituitary adenoma), and seven were evaluated with MR angiography for symptoms such as vertigo or headache unrelated to the aneurysm. Angiographically, the aneurysms arose from the medial wall of the internal carotid artery (ICA) in 10 patients, the lateral wall in 1 patient, the dorsal wall in 2 patients, and the ventral wall in 2 patients. All were small-sized aneurysms. Eleven of the 15 patients were women, and 6 patients were in their 50s.

SURGICAL PROCEDURE

An ipsilateral pterional approach was used in all patients after the ICA was exposed in the neck. In two recently treated patients, a catheter was inserted in the ICA from the femoral artery for temporary balloon occlusion of the ICA and intraoperative angiography. In the procedure used, the sylvian fissure and carotid cistern are opened, and the ICA is exposed. The roof of the optic canal and the anterior clinoid process are removed carefully with a diamond drill. The dura mater around the ICA is cut between the ICA and the optic nerve toward the distal dural ring, and the ophthalmic artery is dissected along its course. If the aneurysmal neck is located totally in the subarachnoid space, neck clipping of the aneurysm can be done without opening the cavernous sinus. When the neck is located in the cavernous sinus even partially, the dural ring is cut circumferentially, and the anterosuperior portion of the cavernous sinus is opened to expose the proximal part of the aneurysm neck. Elevation of the patient's head and Oxy-*cel* packing are necessary to control bleeding from the cavernous sinus. To facilitate dissection and clipping, direct retraction of the ICA is used with intermittent retraction under temporary ICA occlusion. Angled ring clips are usually suitable for obliterating the aneurysms that arise from the medial wall of the ICA, and curved or angled clips are

suitable for those that arise from the lateral, dorsal, or ventral wall of the ICA. After the aneurysm is clipped, Doppler ultrasonography is used to check the adequacy of blood flow in the ICA and the ophthalmic artery. We have recently performed the intraoperative angiography using a digital subtraction angiography system.

RESULTS

All 15 patients underwent craniotomy (Table 1). Neck clipping was performed in 13 patients. In two patients who were treated during the early part of the period studied, the aneurysms were not exposed because of the unavailability of information about the carotid cave at that time. In these patients, some pieces of Bemsheet were wrapped around the ICA at the origin of the ophthalmic artery, including a suspected portion of the aneurysm. The cavernous sinus was opened in six patients based on the intraoperative findings because the proximal part of the aneurysm neck was found to be located in the cavernous sinus.

Based on the operative findings, the types of these aneurysms were identified as follows [9,12,13]: six of the subchiasmatic type, one of the supra-chiasmatic type, two of the lateral chiasmatic type, five carotid cave aneurysms, and one paraclinoid aneurysm.

The angiographical findings of each patient are diagrammed in Figure 1. The aneurysms of the subchiasmatic type arose from the ICA distal to the ophthalmic artery and protruded ventrally in the lateral view. They did not overlap the ICA. In the anteroposterior view, they protruded medially, and the shape was round; on the other hand, in the lateral view, the carotid cave aneurysms appeared to arise from the ICA just proximal to the ophthalmic artery and to protrude ventrally. They overlapped the ICA even when they extended into the cavernous sinus. In the anteroposterior view, they protruded ventromedially and the shape was rather slender when they did not extend into the cavernous sinus. The paraclinoid aneurysms in the lateral view appeared to arise from the ICA just distal to the ophthalmic artery and to protrude ventrally. The aneurysm dome was nearly attached to the intracavernous portion of the ICA. In the anteroposterior view, it overlapped the ICA because of its posterior projection.

Intraoperatively, the subchiasmatic type aneurysms were easily found medial to the ICA after removal of the anterior clinoid process and the roof of the optic canal, but in four of six patients, it was

1 Summary of 15 Patients Treated for Asymptomatic, Unruptured Carotid-Ophthalmic Artery Aneurysms

No.	AGE (YEARS), SEX	SIDE	PRESENTATION	TYPE OF ANEURYSM	OPERATION (CS OPENING)	GOS	COMPLICATION
1	57, F	Lt.	SAH (AcomA)	Subchiasmatic type	Neck clipping (+)	II	(-)
2	51, F	Lt.	None	Subchiasmatic type	Neck clipping (+)	I	(-)
3	45, M	Lt.	None	Subchiasmatic type	Neck clipping	I	(-)
4	46, F	Rt.	None	Subchiasmatic type	Neck clipping (+)	I	Rt. visual field defect
5	71, F	Rt.	None	Subchiasmatic type	Neck clipping (+)	I	(-)
6	50, F	Rt.	SAH (lt. MCA)	Subchiasmatic type	Neck clipping	I	(-)
7	35, M	Lt.	None	Lateral chiasmatic type	Neck clipping	I	Lt. visual field defect
8	47, F	Rt.	SAH (rt. C-O A)	Lateral chiasmatic type	Neck clipping	I	(-)
9	45, F	Lt.	Tumor	Suprachiasmatic type	Neck clipping	II	Lt. blind
10	33, M	Lt.	Infarction	Carotid cave aneurysm	Exploration	I	(-)
11	57, M	Lt.	None	Carotid cave aneurysm	Exploration	I	Wound infection
12	72, F	Lt.	SAH (Trauma)	Carotid cave aneurysm	Neck clipping	I	(-)
13	46, F	Lt.	SAH (lt. MCA)	Carotid cave aneurysm	Neck clipping (+)	I	(-)
14	57, F	Rt.	Infarction	Carotid cave aneurysm	Neck clipping	I	(-)
15	45, F	Lt.	None	Paraclinoid aneurysm	Neck clipping (+)	I	Lt. visual field defect

GOS, Glasgow Outcome Scale; SAH, subarachnoid hemorrhage; AcomA, anterior communicating artery aneurysm; Tumor, pituitary adenoma; MCA, middle cerebral artery aneurysm; C-O A, carotid-ophthalmic artery aneurysm (subchiasmatic type); None, symptoms not related to unruptured carotid-ophthalmic artery aneurysm; CS, cavernous sinus.

necessary to open the cavernous sinus to expose the proximal portion of the aneurysm neck. The carotid cave aneurysms were difficult to find without opening the cavernous sinus or careful exploration at the carotid cave. We could not find this aneurysm in two patients who were treated in the early period because of lack of knowledge about this entity. The aneurysms in three more recently treated patients were clipped successfully, but careful exploration was necessary to find the two small aneurysms. In the paraclinoid aneurysms, the distal portion of the aneurysm neck was easily found ventral to the ICA, but it was necessary to open the cavernous sinus to expose the proximal portion of the neck, as described in more detail below.

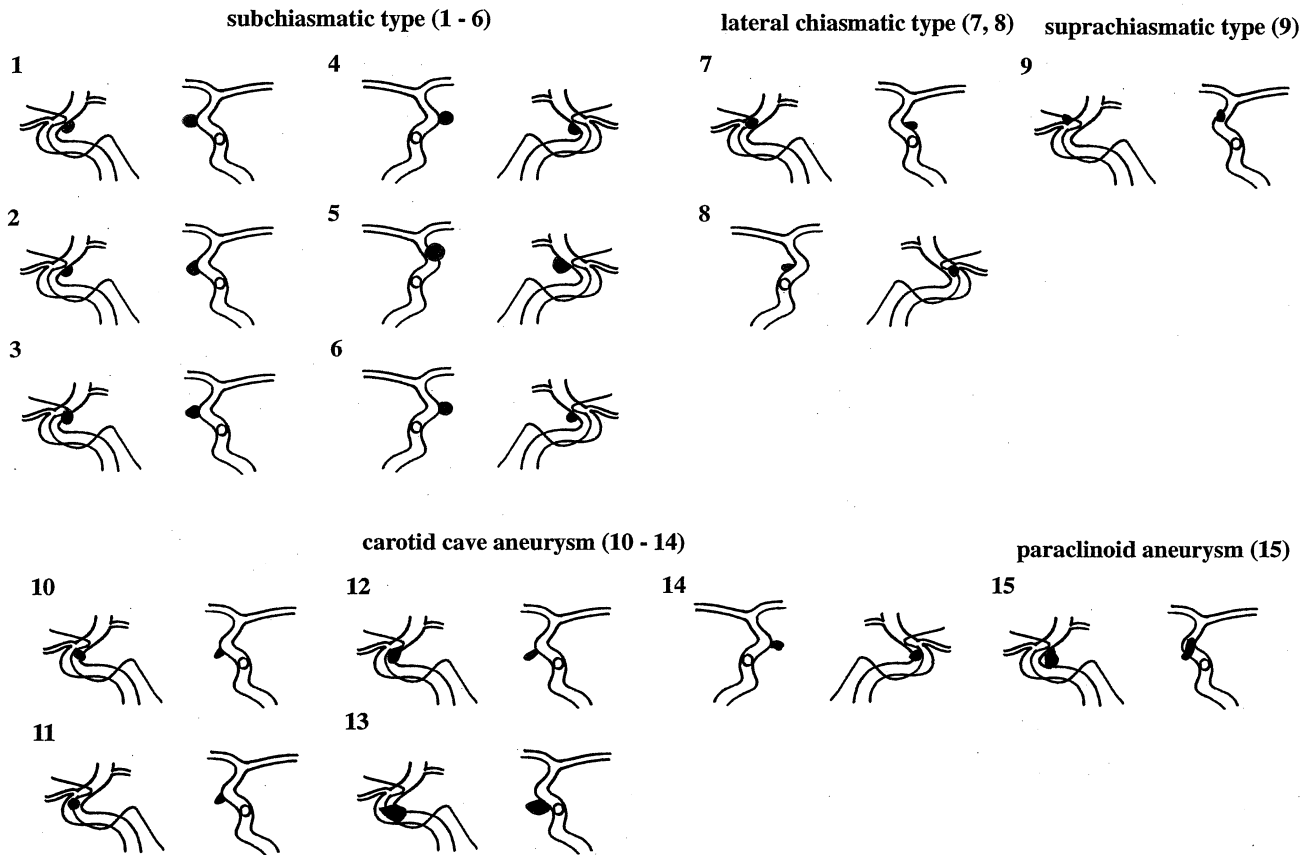
The major complications encountered were visual field defect in three patients and visual loss in one patient. The visual field defect was lower nasal quadrant hemianopsia in two patients (Patient 7, with lateral chiasmatic type aneurysm clipped using the angled clip; patient 15, with paraclinoid aneurysm) and lower hemianopsia in one patient (Patient 4, with subchiasmatic type aneurysm). The patient with postoperative visual loss (Patient 9) had an aneurysm that arose from the anterior wall of the left ICA just distal to the ophthalmic artery. The aneurysm was attached to and compressed on the inferior surface of the left optic nerve. The straight clip was applied after gentle dissection of

the aneurysmal neck from the optic nerve. In this case, we were concerned about the effect of the heat of the diamond drill on the optic nerve during unroofing of the optic canal, so saline was dripped intermittently with a syringe. Postoperatively, the patient showed left visual loss even though postoperative angiography demonstrated preservation of the ophthalmic artery. In all other patients, visual field and acuity were unchanged and normal. Patient 11 developed a wound infection that required reoperation. Oculomotor nerve palsy was not recognized postoperatively in any patient.

The assigned grading of the Glasgow Outcome Scale was I for 13 patients and II for 2 patients. One of the latter patients (Patient 1) showed mild deterioration of mental activity due to a ruptured anterior communicating artery aneurysm, and the other patient (Patient 9) suffered visual loss as a postoperative complication.

ILLUSTRATIVE CASES

PATIENT 4 (SUBCHIASMATIC TYPE ANEURYSM). This 46-year-old woman had suffered from tremor of the right hand for 3 years. She was admitted to our hospital for further examination, and right carotid angiography disclosed a carotid-ophthalmic aneurysm (Figure 2). She did not develop any neurological deficits during the preoperative balloon occlusion test for 30 minutes.



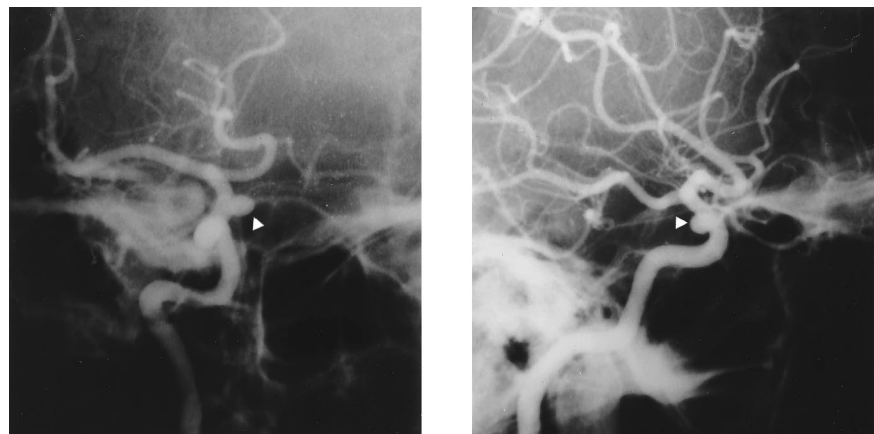
1 Diagrams of the angiographic findings in each patient.

A right pterional approach was used after the right carotid artery was exposed in the neck, and the roof of the optic canal and the anterior clinoid process were removed. The aneurysm was found medial to the ICA, and an oblique-angled ring clip was used to clip the aneurysm. Since the proximal portion of the aneurysm neck was not completely occluded, the dural ring was cut circumferentially

at the lateral portion, and the anterosuperior part of the cavernous sinus was opened. The same clip was again applied to the neck of the aneurysm. The cervical ICA was temporarily occluded for 5 minutes during the clipping procedure.

Postoperatively, patient complained of an ipsilateral lower visual field defect, but right carotid angiography disclosed the preservation of the oph-

2 Patient 4. Right carotid angiograms. (Left) Right anterior oblique view. (Right) Lateral view. Arrowheads indicate the aneurysm.





3 Patient 14. Right carotid angiograms. **(Left)** Anteroposterior view. **(Right)** Lateral view. Arrowheads indicate the aneurysm.

thalmic artery with complete obliteration of the aneurysm.

PATIENT 14 (CAROTID CAVE ANEURYSM). This 57-year-old woman presented with left hemiparesis. MR images disclosed a small infarction in the right basal ganglion, and MR angiography demonstrated a right carotid-ophthalmic aneurysm. Right carotid angiography also depicted the aneurysm that was directed medially (Figure 3). She was admitted to our hospital to undergo surgery 4 months after the ischemia onset. The neurological results at admission were normal, and she did not develop any neurological deficits during the preoperative balloon occlusion test for 30 minutes.

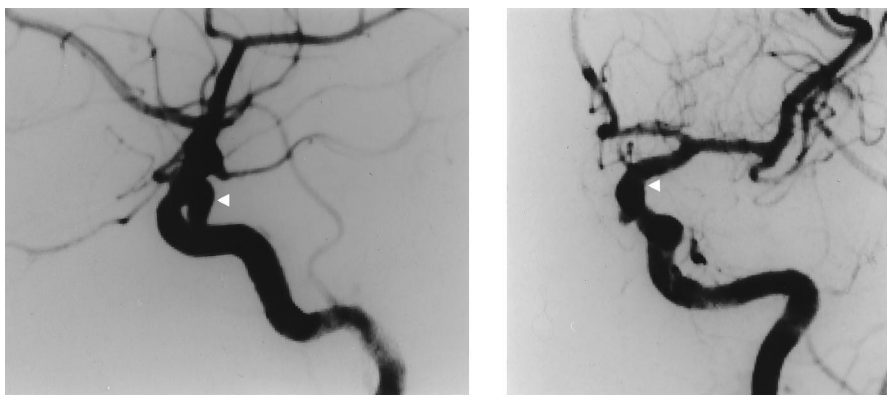
During surgery, the roof of the optic canal and the anterior clinoid process were removed. Since the aneurysm was not found intradurally, the carotid cave was explored carefully after the distal carotid ring was opened. The aneurysm was found in the

carotid cave, and its entire dome was pulled out into the intradural space. A curved clip was used to occlude the aneurysm. The cervical ICA was temporarily occluded with a clip for 6 minutes during the clipping procedure.

The patient was discharged without any neurological deficits.

PATIENT 15 (PARACLINOID ANEURYSM). This 45-year-old woman had had vertigo attacks for 2 years. MR angiography and left carotid angiography disclosed a left carotid-ophthalmic artery aneurysm (Figure 4), and she was referred to our hospital for surgery. She did not develop any neurological deficits during the preoperative balloon occlusion test for 30 minutes.

A left pterional approach was used after a balloon catheter was placed in the ICA, and the roof of the optic canal and the anterior clinoid process were removed. A small distal portion of the aneurysmal



4 Patient 15. Left carotid angiograms. **(Left)** Lateral view. **(Right)** Anteroposterior view. Arrowheads indicate the aneurysm.

neck was found ventral to the ICA in the subdural space, and the proximal portion of the aneurysmal neck and the dome were located in the cavernous sinus. The dural ring was then cut circumferentially at the lateral portion, and the proximal part of the neck was exposed. A curved clip was applied to the neck of the aneurysm. The ICA was temporally occluded with the inflation of a balloon for 5 minutes during the clipping procedure.

Postoperatively, the patient presented ipsilateral lower nasal quadrant hemianopsia even though the left carotid angiography disclosed preservation of the ophthalmic artery with complete obliteration of the aneurysm.

DISCUSSION

Carotid-ophthalmic artery aneurysms arise from the ICA between the origins of the ophthalmic artery and the posterior communicating artery. Successful clipping of these aneurysms has been reported with the advent of microsurgical techniques in recent years [1,2,4,8,9,13]. Some types of these aneurysms, however, such as the carotid cave aneurysm [9] or paraclinoid aneurysm [6,12], still present considerable surgical difficulties without knowledge of these entities. It seems to be useful in the planning of the operative procedure to distinguish among the aneurysm types preoperatively.

CHARACTERISTIC ANGIOGRAPHICAL AND OPERATIVE FINDINGS

The angiographical findings for the subchiasmatic type, carotid cave, and paraclinoid aneurysms are similar because these aneurysms project ventrally. There are some differences, however, in the lateral view: the carotid cave aneurysm arises from the ICA proximal to the ophthalmic artery and overlaps the ICA almost totally, whereas the carotid-ophthalmic aneurysm of the subchiasmatic type arises from the ICA distal to the ophthalmic artery and does not overlap the ICA. In the anteroposterior view, the carotid cave aneurysm usually appears to protrude ventromedially, and the subchiasmatic type appears to protrude medially. Furthermore, the carotid cave aneurysm appears to be slender because it grows in the carotid cave, while the subchiasmatic type aneurysm appears to be rather round. On the other hand, the paraclinoid aneurysm arises from the ICA just distal to the ophthalmic artery and protrudes ventrally, and the dome is almost attached to the intracavernous portion of the ICA because it is located in the cavernous sinus.

The carotid cave aneurysm grows in the small

recess known as the carotid cave with its apex toward the cavernous sinus space, and it is often difficult to expose. Five of our patients had carotid cave aneurysms, but we could not find it in two of them. Kobayashi et al. also reported that they could not find it in two of seven patients with carotid cave aneurysms [9]. Knowledge of this entity is important to surgeons who treat aneurysms in this region. The other three aneurysms were clipped quite satisfactorily after careful exploration of the carotid cave. The cavernous sinus must be opened for successful clipping of the aneurysm neck in these aneurysms. The carotid-ophthalmic aneurysm of the subchiasmatic type is easily found medial to the ICA after removing the anterior clinoid process and the roof of the optic canal, though opening of the carotid dural ring is necessary to obliterate the proximal part of the neck. In the paraclinoid aneurysm, the site of origin is partly intradural and partly intracavernous, and surgical obliteration of this aneurysm is difficult without opening the cavernous sinus [6,12]. We encountered only one patient with this type of aneurysm (Patient 8), and we found only the distal part of the aneurysm neck ventral to the ICA after removing the anterior clinoid process and the roof of the optic canal. We successfully clipped the aneurysm using a curved clip after opening the cavernous sinus to expose the proximal part of the aneurysm neck.

COMPLICATIONS

When we operate on carotid-ophthalmic aneurysms, we must in almost all cases remove the anterior clinoid process and the roof of the optic canal, and in some cases, it is necessary to open the cavernous sinus to clip the aneurysm neck completely. Even after these procedures, some aneurysms are difficult to clip successfully without any complication. Massive infarction caused by obliteration of the ICA has been reported in the past because there was less knowledge of the exposure of the cavernous sinus. Kothandaram reported 2 deaths and 2 hemiplegic patients postoperatively among 10 patients with carotid-ophthalmic artery aneurysms; all 4 of them had the subchiasmatic type of aneurysm [10]. Nutik reported four deaths among five patients with paraclinoid aneurysms after incomplete neck clipping [12]. Even more recently, complications such as visual disturbance have been reported. Kobayashi et al reported two patients whose visual disturbance was exacerbated among seven patients with carotid cave aneurysms [9]. They suspected that the cause of this complication was the manipulation of the optic nerve. Fox reported that two of eight patients with paraclinoid

aneurysms showed transient ipsilateral visual acuity reduction and ipsilateral blindness, and considered retinal ischemia caused by the temporary ICA occlusion and external carotid artery occlusion as the causes of these complications [6].

We encountered visual field defect in three patients and visual loss in one patient even though the ophthalmic artery was preserved in each of these patients. The visual field defects were lower nasal quadrant hemianopsia and lower hemianopsia, which usually develop due to injury of the lateral and upper part of the optic nerve at the optic canal. In these patients, circulatory disturbance of the retina and the optic nerve did not seem to be the cause of complication, given the intraoperative findings and postoperative carotid angiographic findings. We believe that the occurrence of these visual disturbances may result from injury of the ipsilateral optic nerve as a result of excessive retraction or the heat of the diamond drill. Accordingly, we recently introduced continuous saline drip during drilling of the optic canal, and preserved the thin bone that was removed with a curette. Since the inferior lateral wall of the optic canal (situated between the optic nerve and the ICA and known as the optic strut) can be removed only by drilling, we drilled this portion intermittently to minimize the optic nerve's exposure to heat. Cutting the optic nerve sheath at its lateral border is useful to reduce the force of retraction, and observing the circulation of vessels on the surface of the optic nerve is necessary for detection of excessive retraction [9].

The superior hypophyseal artery arises from the medial wall of the ICA, and it carries the blood supply to the optic nerve, optic chiasm, and pituitary gland [11]. Circulatory disturbance of this artery could cause postoperative visual disturbance [3]. There is also some risk of the occlusion of this artery by aneurysm neck clipping in patients with subchiasmatic and carotid cave aneurysms. Although we did not take care to preserve this artery in seven patients with aneurysms of the subchiasmatic type and three patients with carotid cave aneurysms, only one of them (Patient 4) showed a visual field defect. In the other three patients who suffered visual disturbance, this artery was not sacrificed intraoperatively because the aneurysms were located in the lateral, ventral, and dorsal walls of the ICA.

OPERATIVE INDICATIONS

In the past, the operative indications for asymptomatic unruptured carotid-ophthalmic artery aneurysms were not even considered because of the

high mortality and morbidity rates [5,7,10]. Even recently, the operative morbidity of carotid-ophthalmic artery aneurysms seems to be high in comparison with other aneurysms. Though the exact natural course of this aneurysm is unclear, rare occurrence of subarachnoid hemorrhage is reported in the subchiasmatic type of aneurysm [10]. It was also reported that the small paraclinoid variant of the superior hypophyseal artery aneurysm, which seems to be of the same type as the subchiasmatic type of the carotid-ophthalmic artery aneurysm, did not lead to subarachnoid hemorrhage, whereas hemorrhage did develop in 28 of 80 patients with ophthalmic segment aneurysms [3]. When aneurysms of this type enlarge, they produce visual field defects and loss of visual acuity as a result of compression of the undersurface of the optic nerve and chiasm. By that time, they are difficult to clip successfully because direct surgery becomes more dangerous in proportion to their size [8]. At the present time, we can offer no definitive operative indications for asymptomatic, unruptured carotid-ophthalmic artery aneurysms, but we believe that direct operation should be performed with the consent of a patient who has been informed about possible complications and natural course.

Finally, we emphasize that care must be taken to avoid optic nerve injury during the drilling and retraction procedures.

REFERENCES

1. Almeida GM, Shibata MK, Bianco E. Carotid-ophthalmic aneurysms. *Surg Neurol* 1976;5:41-5.
2. Benedetti A, Curri D. Direct attack on carotid ophthalmic and large internal carotid aneurysms. *Surg Neurol* 1977;8:49-54.
3. Day AL. Aneurysms of the ophthalmic segment. A clinical and anatomical analysis. *J Neurosurg* 1990;72:677-91.
4. Dolenc VV. A combined epi- and subdural direct approach to carotid-ophthalmic artery aneurysms. *J Neurosurg* 1985;62:667-72.
5. Drake CG, Vanderlinden RG, Amacher AL. Carotid-ophthalmic aneurysms. *J Neurosurg* 1968;29:24-31.
6. Fox JL. Microsurgical treatment of ventral (paraclinoid) internal carotid artery aneurysms. *Neurosurgery* 1988;22:32-39.
7. Guidetti B, La Torre E. Carotid-ophthalmic aneurysms. A series of 16 cases treated by direct approach. *Acta Neurochir (Wien)* 1970;22:289-304.
8. Heros RC, Nelson PB, Ojemann RG, Crowell RM, De-Brun G. Large and giant paraclinoid aneurysms. Surgical techniques, complications, and results. *Neurosurgery* 1983;12:153-63.
9. Kobayashi S, Kyoshima K, Gibo H, Hegde SA, Takemae T, Sugita K. Carotid cave aneurysms of the internal carotid artery. *J Neurosurg* 1989;70:216-21.
10. Kothandaram P, Dawson BH, Krzyt RC. Carotid-

ophthalmic aneurysms. A study of 19 patients. J Neurosurg 1971;34:544-8.

11. Krisht AF, Barrow DL, Barnett DW, Bonner GD, Shengalaia G. The microsurgical anatomy of the superior hypophyseal artery. Neurosurgery 1994;35:899-903.
12. Nutik S. Carotid paraclinoid aneurysms with intradural origin and intracavernous location. J Neurosurg 1978;48:526-33.
13. Yaşargil MG, Gasser JC, Hodosh RM, Rankin TV. Carotid-ophthalmic aneurysms: direct microsurgical approach. Surg Neurol 1977;8:155-65.

COMMENTARY

Dr. Kumon and his co-authors have given us some useful information here by describing the difficulties and complications in dealing with aneurysms of the proximal carotid intracavernous and para-ophthalmic region. There is no doubt that direct attack on these aneurysms carries a definite risk

that has been well-documented in this paper and by others. I am perhaps a bit surprised at the small size of the aneurysms described in this paper. In asymptomatic patients, I suspect I would have elected to simply follow these aneurysms with MR imaging. We need a better understanding of the natural history of these aneurysms, but certainly the small intracavernous aneurysms must carry a miniscule risk of morbidity and mortality. My experience would suggest that direct surgical repair of these small aneurysms would have to be done with a combined morbidity/mortality of less than 1%.

Sydney J. Peerless, M.D., FRCSC

*Director (Neurosurgeon)
Mercy Neuroscience Institute
Miami, Florida*

DR. PHILLIP O. BRIDENBAUGH [PROFESSOR AND CHAIRMAN, DEPARTMENT OF ANESTHESIA, UNIVERSITY OF CINCINNATI MEDICAL CENTER], SAYS THAT EIGHT MILLION AMERICANS HAVE CANCER, OF WHOM NEARLY HALF SUFFER FROM SOME LEVEL OF PAIN. OF THOSE WITH ADVANCED CANCER, 75 PERCENT HAVE PAIN—MOST OF WHICH CAN BE CONTROLLED THROUGH TREATMENT.

—AMA NEWS RELEASE
JULY 17, 1997