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# *"Kissing Aneurysms" of the Internal Carotid Artery*

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## Abstract

Five patients with kissing aneurysms (adherent internal carotid-posterior communicating artery and ipsilateral internal carotid-anterior choroidal artery aneurysms) are reported. There was female predominance and the subarachnoid hemorrhage was commonly due to rupture of the proximal posterior communicating artery aneurysm. Despite the demonstration of angiographic cleavage, the two aneurysms adhere to each other, which makes surgical dissection difficult. Meticulous dissection of the aneurysmal necks and preservation of the blood flow in the anterior choroidal artery are of vital importance.

**Key words: anterior choroidal artery, kissing aneurysms, posterior communicating artery, subarachnoid hemorrhage**

## Introduction

"Kissing aneurysms" can be defined as two anatomically adjacent aneurysms with separate origins and partially adherent walls. This peculiar situation, which Jefferson first described in 1978,[4] poses some problems for diagnosis and surgical management. The causative aneurysm of the subarachnoid hemorrhage is usually impossible to determine from computed tomographic (CT) scans. The two aneurysms may be recognized as a single multiloculated aneurysm because of close proximity and different size. At surgery, it is not always possible to definitely determine which is the ruptured aneurysm, and this may make further dissection difficult.

Here we describe five patients with kissing aneurysms consisting of an internal carotid-posterior communicating artery (IC-PCoA) aneurysm and an ipsilateral internal carotid-anterior choroidal artery (IC-AchA) aneurysm and discuss the diagnostic and therapeutic problems.

## Case Reports

In the past 7 years, we have treated 531 patients with angiographically proven cerebral aneurysms. 114 patients (21.5%) had IC-PCoA aneurysms and 26 patients (4.9%) had IC-AchA aneurysms. Multiple aneurysms were observed in 116 patients (21.8%). Ipsilateral IC-PCoA and IC-AchA aneurysms occurred in five patients, presenting as kissing aneurysms. In all cases, the kissing aneurysms were treated through the ipsilateral pterional approach.

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**Case 1**: A 66-year-old female developed sudden headache and came to us immediately. She was alert without neurological deficits. CT showed moderate subarachnoid hemorrhage (Fisher[2] group 3). Cerebral angiography demonstrated an IC-PCoA and an IC-AchA aneurysm on the left as well as a right basilar-superior cerebellar artery aneurysm. The IC-PCoA aneurysm was larger than the IC-AchA aneurysm (Fig. 1 *left*). Her preoperative condition according to Hunt and Hess[3] was grade 2.

Surgery to clip the aneurysms was carried out on day 1. It was difficult to determine which aneurysm was ruptured before clipping. The two aneurysms were partially adherent to each other despite the angiographic cleavage. The IC-PCoA aneurysm was clipped first with temporary occlusion of the proximal ICA and the $A_1$ segment of the left anterior cerebral artery for 15 minutes. The IC-PCoA aneurysm was ruptured while the IC-AchA aneurysm was unruptured. The IC-AchA aneurysm

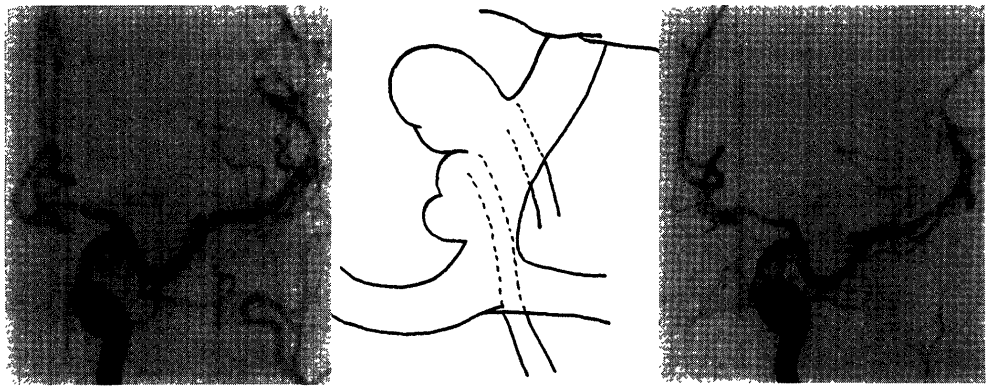

Fig. 1 Case 1. *left*: Preoperative left carotid angiogram, demonstrating the IC-PCoA and IC-AchA aneurysms. The IC-PCoA aneurysm is larger than the IC-AchA aneurysm. *center*: Diagram of intraoperative view, showing the biloculated IC-AchA aneurysm. *right*: Postoperative angiogram, showing successful clipping.

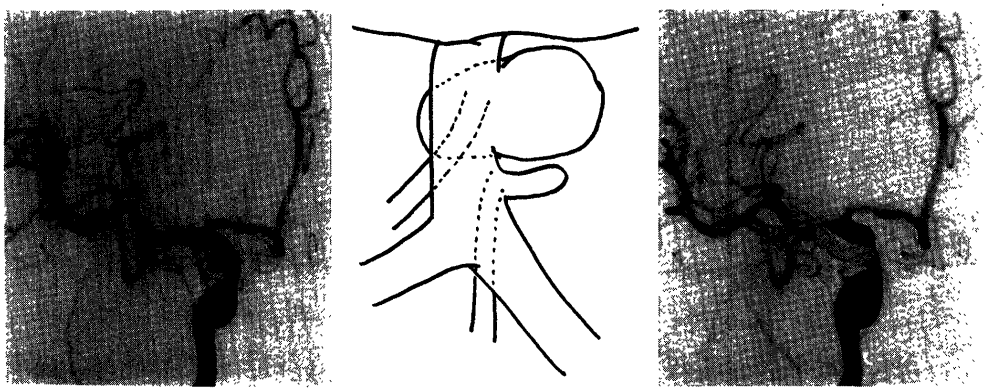

Fig. 2 Case 2. *left*: Preoperative right carotid angiogram, demonstrating the IC-PCoA and IC-AchA aneurysms, but a middle cerebral artery bifurcation aneurysm is not shown. *center*: Diagram of intraoperative view, showing the proximal aneurysm is so large that the medial wall is extruded into the space between the ICA and the optic nerve. *right*: Postoperative angiogram, showing the three aneurysms clipped.

was biloculated and so small that only the distal locule was clipped (Fig. 1 *center*). The blood flow in the AchA was then confirmed. The remaining locule was coated with a small neurosurgical cotton sheet (Bemsheets; Kawamoto Houtai Zairyou, Osaka) and fibrin glue. The right basilar-superior cerebellar artery aneurysm was also small so it was coated in the same manner (Fig. 1 *right*).

Postoperatively, she remained drowsy and had mild right hemiparesis, probably due to the temporary occlusion. At the last follow-up examination 1.5 years postictus, she was moderately disabled with minimal right hemiparesis.

**Case 2**: A 52-year-old female developed sudden severe headache. On admission (2 hours after ictus), she was drowsy but with no other focal neurological signs. CT showed moderate subarachnoid hemorrhage, more severe on the right than on the left (Fisher group 3). Angiography demonstrated an IC-PCoA and an IC-AchA aneurysm as well as a middle cerebral artery aneurysm, all on the right. The proximal IC-PCoA aneurysm was larger than the IC-AchA aneurysm. These aneurysms were best demonstrated in the oblique views (Fig. 2 *left*). Her preoperative condition was Hunt and Hess grade 2.

On the same day as admission, the three aneurysms were clipped. After clipping the middle cerebral artery aneurysm, the ICA aneurysms were explored. Despite the angiographic cleavage between the two aneurysms, there was a tight arachnoid membrane bridge between them. There was insufficient space for temporary clipping at the proximal ICA (Fig. 2 *center*). Although it was not so difficult to separate the two aneurysms, it was difficult to expose the neck of the IC-PCoA aneurysm since the aneurysm was large and the neck was located in the

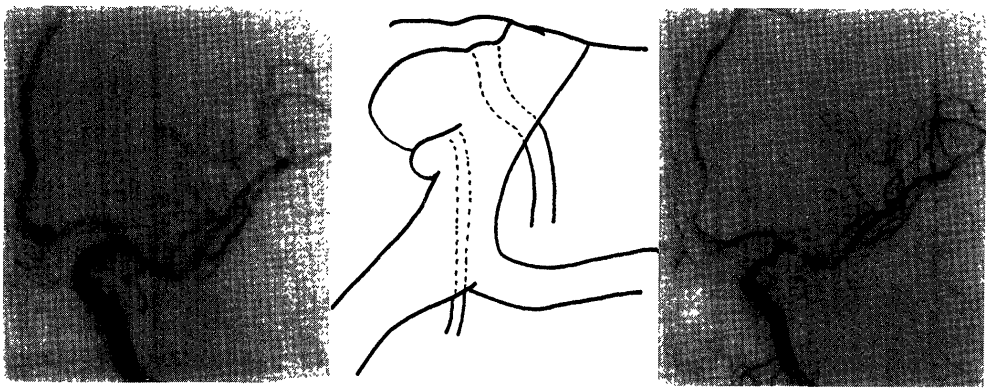

Fig. 3 Case 3. *left*: Preoperative left carotid angiogram, showing the IC-PCoA and IC-AchA aneurysms. The two aneurysms appear the same size, but the lateral view (not shown) indicates the IC-PCoA aneurysm is larger than IC-AchA aneurysm. *center*: Diagram of intraoperative view, showing the two aneurysms tightly adhered to each other. *right*: Postoperative angiogram.

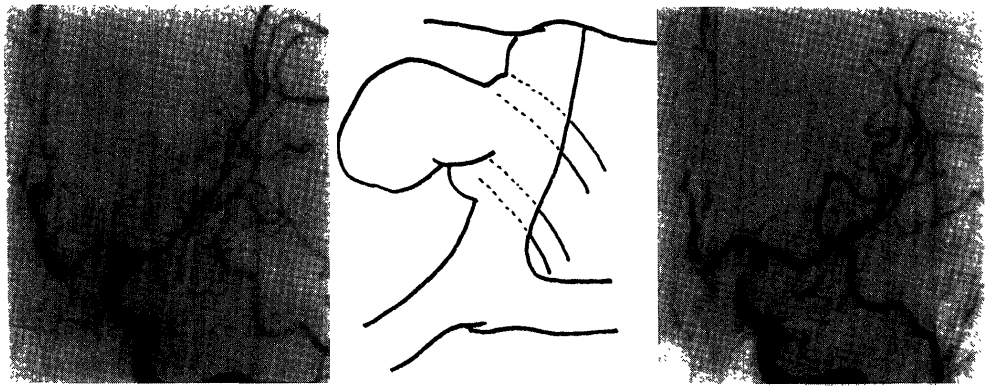

Fig. 4 Case 4. *left*: Preoperative left carotid angiogram, showing the IC-PCoA and IC-AchA aneurysms as well as the left distal anterior cerebral artery aneurysm. Based on this image, the IC-AchA aneurysm might be overlooked because of the larger IC-PCoA aneurysm. *center*: Diagram of intraoperative view, showing the two aneurysms tightly adherent and the IC-AchA aneurysm not clipped for fear of compromising the flow in the AchA. *right*: Postoperative angiogram, showing the successful clipping of the IC-PCoA and the anterior cerebral artery aneurysms. The IC-AchA aneurysm is demonstrated since this aneurysm was only coated.

ventrolateral aspect of the carotid artery. The IC-PCoA aneurysm had ruptured, and was clipped with two clips. The IC-AchA aneurysm had a thick wall and was obviously unruptured. After identification of the AchA, the IC-AchA aneurysm was clipped without difficulty (Fig. 2 *right*).

Her postoperative course was uneventful and she was discharged about 1 month later without neurological deficits.

**Case 3**: A 39-year-old female suddenly developed alteration in consciousness. On admission 2 hours later, she was drowsy but with no motor weakness. CT showed diffuse severe subarachnoid hemorrhage without laterality (Fisher group 3). Angiography demonstrated an IC-PCoA and an IC-AchA aneurysm on the left. The IC-PCoA aneurysm was slightly larger. These aneurysms were separately demonstrated only in the oblique views (Fig. 3 *left*). Her preoperative condition was Hunt and Hess grade 3.

The two aneurysms were clipped on the day of admission. Angiography had demonstrated a space between the two aneurysms, but the intraoperative finding was adherence (Fig. 3 *center*). The aneurysms were separated carefully. The IC-PCoA aneurysm had ruptured. Blood flow in the AchA was confirmed after clipping (Fig. 3 *right*).

The postoperative course was uneventful until she developed symptomatic vasospasm in the territory of the right middle cerebral artery on day 8. She became somnolent with left hemiparesis. Hypervolemic therapy achieved no improvement. Five months after

the operation, she demonstrated minimal mental slowness and mild left hemiparesis, and could walk with a T-cane.

**Case 4**: A 53-year-old female suddenly became drowsy and was transferred to us 4 days later. On admission, she was drowsy with right hemiparesis (3/5 by the manual muscle strength test), and aphasic. CT showed dense hematoma mainly within the temporal lobe but partially in the Sylvian fissure, and minimal subarachnoid hemorrhage in the basal cistern (Fisher group 4). Angiography demonstrated an IC-PCoA and an IC-AchA aneurysm as well as a distal anterior cerebral artery aneurysm, all on the left, with minimal angiographic vasospasm. The IC-PCoA aneurysm was larger than the IC-AchA aneurysm (Fig. 4 *left*). Her preoperative condition was Hunt and Hess grade 4.

The aneurysms were clipped on day 6. The IC-PCoA and the IC-AchA aneurysms were tightly adhered to each other. Although the left IC-PCoA aneurysm was successfully clipped, the IC-AchA aneurysm could not be clipped for fear of compromising blood flow in the AchA (Fig. 4 *center*). The IC-AchA aneurysm was coated with a neurosurgical cotton sheet and fibrin glue. The hematoma in the temporal lobe was removed. The left anterior cerebral artery aneurysm was clipped through an additional right frontal small craniotomy (Fig. 4 *right*).

Postoperatively, her right hemiparesis and total aphasia improved gradually. About 1 month later, a ventriculoperitoneal shunt was inserted. Three months after the first operation, she had no motor weakness and showed only mild sensory aphasia.

**Case 5**: A 58-year-old male was found unconscious on the street and was transferred to us next day. Head trauma could not be eliminated as a cause of the unconsciousness. On admission, he was somnolent and restless without apparent weakness. Skull x-ray films demonstrated no fracture. CT showed moderate contusion in the left frontal lobe and subarachnoid hemorrhage in the left Sylvian fissure (Fisher group 2). Angiography demonstrated an IC-PCoA and an IC-AchA aneurysm on the left. The IC-AchA aneurysm was larger. These two aneurysms were best shown in the oblique views (Fig. 5 *left*).

Clipping was carried out on the day of admission. Intraoperative examination found the left frontal lobe was contused, probably due to head trauma, and subarachnoid hemorrhage was minimal. The arachnoid membrane of the proximal Sylvian fissure was lacerated. After dissection of the arachnoid membrane between the aneurysms, a cleavage between them was found as shown by angiography. Both aneurysms were unruptured and were clipped successfully (Fig. 5 *right*).

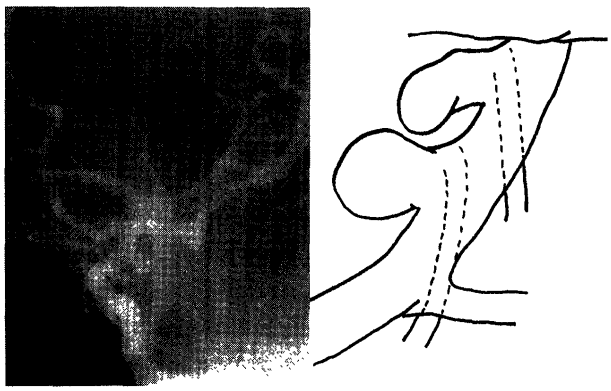

Fig. 5 Case 5. *left*: Left carotid angiogram, demonstrating the IC-PCoA and IC-AchA aneurysms. The distal IC-AchA aneurysm is larger than the proximal one. *right*: Diagram of intraoperative view, showing both aneurysms unruptured.

He recovered completely except for left oculomotor nerve paresis caused by the intraoperative manipulation, which completely disappeared in 2 months. No postoperative angiography was performed.

## Discussion

Yasargil[6] reported 173 patients (17%) with IC-PCoA aneurysms among 1012 patients with cerebral aneurysms, and 21 patients (2.1%) with IC-AchA aneurysms. The incidence of kissing aneurysms was only two of 1012 patients, 0.2% of the series. We experienced five patients with kissing aneurysms among 531 patients, 0.9% of the total.

Jefferson[4] suggested a hereditary basis for kissing aneurysms since two of his five patients had a familial history of subarachnoid hemorrhage. Our series showed no familial history of the cerebral aneurysms. Any hereditary basis for kissing aneurysms remains uncertain.

Combining the present and previous cases,[4,6] 10 patients were female and two were male, aged from 21 to 66 years (mean 42.8 yrs). All 10 female patients had ruptured aneurysms while two male patients had unruptured aneurysms. The ruptured aneurysms were always the proximal IC-PCoA aneurysms, although the ruptured aneurysm was not specified in four cases.[4] The proximal aneurysms were larger than the distal aneurysms in seven cases, the distal aneurysms were larger than the proximal aneurysms in four, and the relative size was unknown in one. The laterality of the aneurysms was evenly dis-

tributed, six cases on each side. In our series, three patients had three aneurysms each. Multiplicity (more than 2) of aneurysms is a possibility in kissing aneurysms, so thorough angiographic study is essential.

In addition to kissing aneurysms of the IC-PCoA and the IC-AchA, similar kissing aneurysms may be formed by basilar tip-superior cerebellar artery aneurysms, bilateral pericallosal artery aneurysms (mirror image aneurysms), and multiple aneurysms of the anterior communicating or the middle cerebral artery. However, no such situations have been reported as kissing aneurysms.

Kissing aneurysms may be misinterpreted as a single multiloculated aneurysm.[4] When correctly identified, CT cannot determine the causative aneurysm of subarachnoid hemorrhage. Specific angiographic findings such as mass sign and local spasm also cannot identify the ruptured aneurysm. Other angiographic findings such as larger size and bleb formation at the aneurysmal dome are suggestive of recent rupture,[5] but are not always true in kissing aneurysms since the unruptured IC-AchA aneurysms were larger than the ruptured IC-PCoA aneurysms in the Yasargil series.[6] Close proximity and differences in the size of kissing aneurysms can cause one of the aneurysms to be overlooked by cerebral angiography with the conventional anteroposterior and lateral projections. Additional oblique imaging with different angles and/or stereoscopic imaging are useful (Cases 2, 3, and 5). Although all the ruptured aneurysms reported were IC-PCoA aneurysms, it is not always easy to identify the ruptured aneurysm even during surgical exposure. Adhesion between the two aneurysms makes the dissection more difficult. Cerebral angiography may demonstrate a cleavage plane between the two aneurysms, but it is highly likely that the two aneurysms are tightly adherent. This discrepancy between the angiographic and operative findings may be due to: 1) a thick arachnoid membrane between them, 2) thick aneurysmal wall, and 3) difficulty in determining the real necks of the aneurysms angiographically, giving the false impression that the angiographic cleavage is a common neck for the two aneurysms.

Surgical treatment requires careful dissection of the aneurysmal necks and the AchA to avoid premature rupture and laceration of the aneurysmal walls. Since the AchA is located behind the aneurysms in most cases, temporary clipping of the proximal ICA is sometimes necessary to reduce the intraluminal pressure for dissection of the AchA. In all our cases except Case 4, dissection between the two aneurysms and the AchA was finally accomplished, and clipping after dissection was not so difficult. If there is insufficient cleavage between the two aneurysms, one clip might be applied parallel to the carotid artery, as Jefferson[4] suggested, occluding the two aneurysms at once. A fenestrated clip (Sugita clip) or an encircling clip might be necessary in some cases. It is also important to avoid injury to the perforating arteries originating from the PCoA. An aneurysm clip that is too long may occlude these small vessels.

Preservation of the blood flow in the parent artery, especially in the AchA, is important because of the possible discrepancy between angiographic and operative findings. Occlusion or kinking of the AchA might cause "Abbie syndrome," with resultant hemiplegia, hemianalgesia, and homonymous hemianopsia on the contralateral side.[1] Tight clipping of the neck of the AchA aneurysm may cause this syndrome due to compromise of blood flow in the AchA.

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## References

1) Abbie AA: The clinical significance of the anterior choroidal artery. *Brain* 56: 233-246, 1933
2) Fisher CM, Kistler JP, Davis JM: Relation of cerebral vasospasm to subarachnoid hemorrhage visualized by computerized tomographic scanning. *Neurosurgery* 6: 1-9, 1980
3) Hunt WE, Hess RM: Surgical risk as related to time of intervention in the repair of intracranial aneurysms. *J Neurosurg* 28: 14-20, 1968
4) Jefferson A: The significance for diagnosis and for surgical technique of multiple aneurysms of the same internal carotid artery. *Acta Neurochir (Wien)* 41: 23-37, 1978
5) Wood EH: Angiographic identification of the ruptured lesion in patients with multiple cerebral aneurysms. *J Neurosurg* 21: 182-198, 1964
6) Yasargil MG: Internal carotid artery aneurysms, *in* Yasargil MG (*ed*): *Microneurosurgery, vol 2*. Stuttgart, Georg Thieme Verlag; New York, Thieme-Stratton, 1984, pp 33-123

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