Treatment of Intradural Paraclinoidal Aneurysms

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Abstract

Intradural paraclinoidal aneurysm still presents conceptual confusion and technical surgical problems. The clinical features of 68 consecutive patients with paraclinoidal aneurysms were analyzed. The pterional approach was used in all patients. Subarachnoid hemorrhage (SAH) occurred in 37 patients from the paraclinoidal aneurysm and in 10 patients from another associated aneurysm. Thirty-four of the 37 ruptured paraclinoidal aneurysms were clipped, two blister-like aneurysms required trapping, and one blister-like aneurysm was coated. Thirteen of the 31 unruptured paraclinoidal aneurysms, consisting of 10 with ruptured associated aneurysm, four symptomatic, and 17 incidental, were clipped and 18 were coated. Favorable outcomes were obtained in 38 of 47 patients with SAH and 17 of 21 patients without SAH. Nine unfavorable outcomes in SAH patients were caused by primary brain damage (5), vasospasm (2), cerebral infarction after trapping (1), and pneumonia (1). All four unfavorable outcomes in non-SAH patients were due to surgical procedures for giant aneurysms or associated basilar artery aneurysm. Removal of the anterior clinoid process was performed to secure the proximal neck in 15 patients with large or giant aneurysms. Multiple clips with or without fenestrated clips were required in all giant aneurysms, and exposure of the cervical internal carotid artery (ICA) in 17 giant or large aneurysms. Fenestrated clips were also useful for one small aneurysm projecting posteriorly. A favorable outcome was achieved in 17 of 19 patients undergoing coating. Coating without clipping might be better for some blister-like ICA aneurysms, even if ruptured. Paraclinoidal aneurysms can be clipped with favorable results using these techniques except for giant aneurysms and associated basilar artery aneurysm.

Key words: paraclinoidal aneurysm, clipping, surgical approach, outcome

Introduction

Aneurysms arising from the intradural portion of the internal carotid artery (ICA) proximal to the origin of the posterior communicating artery (PcomA) are traditionally called ophthalmic artery aneurysms,^{1,4,8,9)} but have also been called aneurysms of the ophthalmic segment⁶⁾ or paraclinoidal aneurysms.^{2,3,10,11,16,22,23)} We prefer the term paraclinoidal aneurysm, because the origin of the aneurysmal neck is not always related to the ophthalmic artery.

Paraclinoidal aneurysms account for approxi-

mately 5% of all intracranial aneurysms,^{11,14)} and are characterized by a marked female predominance and high incidence of giant and multiple aneurysms.²³⁾ Paraclinoidal aneurysms are a challenge to the neurosurgeon because of the anatomical complexity. The optic nerve and anterior clinoid process are the major obstacles to intracranial control of the proximal ICA. Large and giant aneurysms may involve the whole of the ICA, obscuring the origin of the neck.¹²⁾ The choice of surgical approach and techniques are also debatable due to variations in the projection of the aneurysm and the position of the aneurysmal neck. A few excellent descriptions of surgical results are available,^{2,6)} but little discussion of the precise relationship between the clinical grade and surgical outcome

with regard to ruptured paraclinoidal aneurysm.

The present study retrospectively analyzed a series of 68 patients with paraclinoidal aneurysm to evaluate the optimum surgical technique and surgical outcome.

Materials and Methods

This series included 68 consecutive patients with paraclinoidal aneurysm operated on by one neurosurgeon (H.N.) from 1986 to 1997. All cases were proven to be intradural aneurysms, and cavernous aneurysms were excluded from this series. Angiography was performed to determine the location and the size of the aneurysm. Large and giant aneurysms were defined as having a maximum diameter exceeding 15 mm and 25 mm, respectively. Clinical grading of cases of subarachnoid hemorrhage (SAH) was determined using Hunt and Kosnik's classification¹³⁾ just before surgery. Surgery within 3 days of onset was termed early surgery and surgery after 3 days was termed late surgery.

Surgical procedures were clipping, trapping, and plastic coating with oxidized cotton and Biobond® (EDH adhesive; Yoshitomi Pharmaceuticals, Osaka). The cervical portion of ICA was exposed in patients with large and giant aneurysms. During the surgery, moderate hypotension of 90–100 mmHg was induced during clipping and 300–500 ml of mannitol was administered for neuroprotection. Surgical outcome was evaluated at discharge using the following grading scale: excellent, full recovery; good, return to previous occupation but with minor deficits; fair, independent with moderate neurological deficits; poor, fully dependent due to severe neurological deficits; and dead.

Results

I. Clinical characteristics of patients

The patients were aged 26–82 years old (mean 52.3

Table 1 Summary of cases

Initial symptoms	Size of aneurysms*		Total
	Small/ large	Giant	
SAH from ruptured paraclinoidal aneurysm	31	6	37 (54%)
SAH from ruptured associated aneurysm	10	0	10 (15%)
Visual field defect	0	4	4 (6%)
Incidental	12	5	17 (25%)
Total	53 (78%)	15 (22%)	68 (100%)

*Small: maximum diameter of ≤ 15 mm, large: maximum diameter of > 15 to 25 mm, giant: maximum diameter of > 25 mm. SAH: subarachnoid hemorrhage.

years old). Of the 37 ruptured paraclinoidal aneurysms, six were giant and seven were blister-like ICA aneurysms. Of the 31 unruptured aneurysms, including nine giant aneurysms, 10 were associated with ruptured aneurysm at other locations, 17 were incidentally diagnosed, and the other four were symptomatic manifesting as visual field defect (VFD) before diagnosis (Table 1). The 10 ruptured associated aneurysms were located as follows: ICA in seven (terminal ICA in 3 and ICA-PcomA in 4), anterior communicating artery in two, and middle cerebral artery in one. Ten of the 17 patients with incidental paraclinoidal aneurysm presented with mild headache, four with cerebral infarction, and one each with head trauma, convulsion, or pituitary adenoma.

Table 2 shows the clinical grades and the timing of surgery in 47 patients with SAH. Early surgery and late surgery were almost equally common in 37 patients with ruptured paraclinoidal aneurysm. Twenty-seven of the 37 patients were classified into grades I and II, and 10 into grades III to V. Early surgery was more frequently performed on patients in high grades. Eight of 10 patients with ruptured

Table 2 Clinical grades and timing of the operation in subarachnoid hemorrhage

Operation timing*	Clinical grades before operation						Total
	I	Ia	II	III	IV	V	
Ruptured paraclinoidal aneurysm	15	5	7	6	4	0	37
early surgery	2	0	7	6	3	0	18
late surgery	13	5	0	0	1	0	19
Ruptured associated aneurysm	1	1	1	5	2	0	10
early surgery	0	0	1	5	2	0	8
late surgery	1	1	0	0	0	0	2

*Early surgery: within 3 days of onset, late surgery: after 3 days of onset.

associated aneurysm underwent early surgery and two had late surgery. Only three of the 10 patients were in grades I and II, and seven in grades III to V.

II. Surgical techniques

The ipsi- or contralateral pterional approach was adopted for all cases. The contralateral approach was employed only for four unruptured paraclinoidal aneurysms.

Thirty-four of 37 ruptured paraclinoidal aneurysms were clipped, two blister-like aneurysms

required trapping because of intraoperative rupture, and one blister-like aneurysm was coated because the small aneurysm had a wide neck. Thirteen of the 31 unruptured aneurysms were clipped, nine of which were giant aneurysms, and 18 were coated.

Multiple clips were applied to all 15 giant aneurysms. Single fenestrated clips were used for 13 subchiasmal type aneurysms which projected inferomedially and the aneurysmal dome was located mainly under the chiasm. Cervical ICA exposure prior to craniotomy was performed for 13 giant and

Table 3 Overall surgical results

Aneurysms and clinical grades	Overall surgical results					Total
	Excellent	Good	Fair	Poor	Dead	
Ruptured paraclinoidal aneurysm	24 (5)	7 (1)	1	1	4	37 (6)
grade I	13	2	0	0	0	15
Ia	4	1	0	0	0	5
II	2	2	1	0	2	7
III	4	2	0	0	0	6
IV	1	0	0	1	2	4
Ruptured associated aneurysm	6	1	0	2	1	10
grade I	1	0	0	0	0	1
Ia	1	0	0	0	0	1
II	1	0	0	0	0	1
III	3	1	0	0	1	5
IV	0	0	0	2	0	2
Incidental aneurysm	12 (3)	3 (1)	2 (1)	0	0	17 (5)
Symptomatic aneurysm	1 (1)	1 (1)	1 (1)	0	1 (1)	4 (4)
Total	43 (9)	12 (3)	4 (2)	3 (0)	6 (1)	68 (15)

(): number of giant aneurysms.

Table 4 Summary of 13 patients with unfavorable outcome

Case No.	Age	Initial symptoms (clinical grade)	Size of aneurysm	Premature rupture	Operation	Outcome	Cause of outcome
Ruptured paraclinoidal aneurysm:							
1	46	SAH (IV)	small	—	clipping	dead	PBD
2	57	SAH (IV)	small	—	clipping	dead	PBD
3	50	SAH (II)	small	—	clipping	fair	vasospasm
4	26	SAH (II)	large	+	trapping	dead	pneumonia
5	49	SAH (II)	small	+	trapping	dead	infarction
6	60	SAH (IV)	small	—	clipping	poor	PBD
Ruptured associated aneurysm:							
7	49	SAH (IV)	small	—	coating	poor	PBD
8	64	SAH (IV)	small	—	clipping	poor	PBD
9	74	SAH (III)	small	—	coating	dead	vasospasm
Symptomatic aneurysm:							
10	50	VFD	giant	—	clipping	dead	surgical procedure
11	59	VFD	giant	—	clipping	fair	surgical procedure
Incidental aneurysm:							
12	49	trauma	small	—	clipping	fair	surgical procedure
13	59	headache	giant	—	clipping	fair	surgical procedure

PBD: primary brain damage, SAH: subarachnoid hemorrhage, VFD: visual field defect.

four large aneurysms. Removal of the anterior clinoid process was required in 15 patients with large or giant aneurysms to secure the proximal neck. However, the proximal neck of 53 patients could be secured by either removal of the dura adjacent to aneurysm or mild retraction of the ICA or optic nerve without removal of the anterior clinoid process. Puncture and suction of the aneurysmal dome were utilized in two giant aneurysm cases because of difficult dissection of the aneurysmal neck.

III. Surgical outcomes

Favorable outcomes (excellent and good) were achieved in 31 of 37 patients with ruptured paraclinoid aneurysms, seven of 10 patients with ruptured associated aneurysms, and 17 of 21 patients with incidental or symptomatic paraclinoid aneurysms (Table 3).

Thirteen patients had an unfavorable outcome at discharge (Table 4). Among the nine patients with SAH, the cause of the unfavorable outcome was primary brain damage in all five patients in clinical grade IV, but vasospasm in two patients in grade II or III. Two deaths were caused by cerebral infarction resulting from ICA trapping and postoperative pneumonia in one patient each. The four unfavorable outcomes in incidental and symptomatic cases were due to surgical procedures for giant aneurysm (3) or associated basilar artery aneurysm (1).

Four of the seven blister-like aneurysms were uneventfully clipped, but two cases required trapping of the ICA because of uncontrollable bleeding and resulted in cerebral infarction and death in one patient. The other blister-like aneurysm was safely coated and the patient obtained a favorable outcome.

Twelve of 15 patients with giant paraclinoid aneurysm had a favorable outcome, including all six with ruptured giant aneurysm. Two had a fair outcome and one died. Seventeen of 19 patients undergoing coating of the aneurysm had a favorable outcome, and no rebleeding occurred during the follow-up period. The two unfavorable outcomes were due to vasospasm and primary brain damage.

There was no significant difference in outcome related to the timing of operation in ruptured paraclinoid aneurysm: 14 of 18 cases treated by early surgery and 17 of 19 cases treated by late surgery had a favorable outcome.

Discussion

I. Surgical techniques

The ipsilateral pterional approach seems to be the most common approach for these aneurysms, as in

our series. The basal frontal cut of the pterional craniotomy can be extended by 2 or 3 cm to provide a better view and more room to work frontally in patients with giant aneurysms.¹²⁾ The combined epi- and subdural direct approach can expose the distal portion of the cavernous sinus.⁷⁾ However, we have no experience of the combined epi- and subdural approach, since this approach is not necessary for the surgical treatment of intradural paraclinoid aneurysm. Some neurosurgeons prefer the contralateral pterional approach which does not require removal of the medial part of the frontal base bone, and allows minimal manipulation of the optic nerve and easy securing of the superior hypophyseal artery. However, the contralateral approach cannot be recommended in cases with prefixed chiasma or large or giant aneurysms.^{18,19,25,27)} We utilized the contralateral approach only for four small paraclinoid aneurysms associated with other ruptured aneurysms.

Cervical exposure prior to craniotomy is recommended to expose the carotid bifurcation in the neck in patients with giant aneurysm.^{11,12)} This technique is essential to reduce the blood flow when premature rupture occurs and the proximal neck is not secured. We exposed the cervical bifurcation only in cases of large or giant aneurysm. Removal of the anterior clinoid process permits visualization of approximately 6 mm more of the proximal ICA without entering the cavernous sinus.²⁴⁾ The clinoid resection clearly benefits the exposure of carotid-ophthalmic complex and proximal posterior carotid artery wall aneurysms.²⁾ This procedure is also necessary in cases of giant aneurysm to facilitate securing of the proximal neck of the aneurysm and to increase optic nerve mobility. On the other hand, when the proximal neck is distal to the origin of ophthalmic artery, the proximal portion of the ICA can be secured by resecting the dura attached to the ICA and optic nerve without removal of the anterior clinoid process.²¹⁾ We removed the anterior clinoid process in 15 cases of giant aneurysms or large aneurysms with the proximal neck located proximal to the origin of the ophthalmic artery. Furthermore, gentle retraction of the optic nerve and ICA facilitated the dissection of the aneurysmal neck and clipping.¹⁷⁾

Fenestrated clips were useful for the clipping of aneurysms projecting posteriorly, but care should be taken not to sacrifice the PcomA. It is also important to apply the clip parallel to the ICA.²⁰⁾ Blister-like ICA aneurysms frequently need to be clipped together with a part of the ICA wall when the aneurysm is small and slippery. Such aneurysms sometimes undergo intraoperative rupture which

then requires the trapping procedure. We experienced two cases of blister-like aneurysms which ruptured intraoperatively and required trapping, one of which resulted in cerebral infarction and death.

The most important and difficult point in the management of giant aneurysms is to secure the proximal and distal neck. Blood flow control with repeated interruption of the cervical ICA is helpful for wide dissection of giant aneurysms. However, trapping might be needed when cervical ICA interruption fails to achieve an adequate decrease of intraaneurysmal pressure. To avoid narrowing of the ICA lumen, the clip should be applied to the aneurysmal dome 2–3 mm distal to the neck if the neck is wide and/or the wall is thick. Multiple clips are also recommended to achieve complete clipping against the high intraaneurysmal pressure. At the same time, care should be taken not to sacrifice the anterior choroidal artery.²⁰⁾

We obtained favorable results in 17 of 19 cases with coating without clipping. We used this technique only for unruptured wide neck aneurysms which seemed to be unclippable, except for one case of ruptured blister-like aneurysm. Oxidized cotton with Biobond was utilized for coating. No bleeding was recognized during hospitalization in our cases. The risk of recurrent hemorrhage after total coating with Biobond is 33%, so reinforcement of ruptured aneurysms with Biobond may have little value.¹⁵⁾ On the other hand, long-term follow-up study of patients treated by coating showed that coating of the aneurysmal wall provided some protection in patients with “unclippable” aneurysms and should be used only in very selected cases.²⁶⁾ Employment of bioadhesive agents may reduce the rate of bleeding.⁵⁾

Recently, a combined method was proposed using an endovascular and neurosurgical approach to treat paraclinoidal aneurysms.¹⁶⁾ This approach is useful particularly for large or giant ICA aneurysms, but further refinement of the balloon catheter is needed to prevent complications related to thrombus formation.

II. Surgical outcome

In 1984, a series of 21 patients with aneurysms of the ICA inferior wall was described.²⁸⁾ These aneurysms are thought to have been paraclinoidal aneurysms. Late surgery achieved a good outcome for all patients in grades I and II in the series. However, individual treatment planning is required for the aneurysm of this location, since the aneurysm of this segment is sometimes large or sclerotic, and involves a small artery on the surface. More recent small series of paraclinoidal aneurysms

have also reported good outcomes in most patients.^{10,23)} A series of 34 patients with large or giant paraclinoidal aneurysms showed a favorable outcome in 29, except those with VFD.¹²⁾ Although paraclinoidal aneurysms less than 15 mm in diameter did not yield distinct surgical problems, the outcomes are not known. Another series of 41 patients with giant paraclinoidal aneurysm showed similar results as a favorable outcome was obtained in 36, but only 12 had improved visual condition, although the outcome in clinical grading was not described.¹¹⁾ In a series of 80 aneurysms of the ophthalmic segment, 23 patients presented with SAH (clinical grade unknown), 24 had VFD, five had both SAH and VFD, and 28 were found incidentally.⁶⁾ Forty-seven of 54 patients followed up had a favorable outcome, four had a poor outcome, and three died. Causative factors of the seven unfavorable outcomes were vasospasm (4), complication (2), and surgical procedure (1). A recent series of 89 patients included 39 with SAH (clinical grade unknown) and 22 of giant paraclinoidal aneurysms.²⁾ Overall surgical outcomes showed that 86.5% were good, 9% were fair, 3% were poor, and 1% died. Causative factors of the poor outcomes were not clearly discussed.

Overall surgical results in our series are comparable with these reports. The causative factors of the poor outcomes in our patients with SAH were vasospasm in grade III, primary brain damage in grade IV, and vasospasm, postoperative pneumonia, and cerebral infarction resulting from ICA trapping in grade II. On the other hand, the surgical procedure for giant aneurysm or associated basilar artery aneurysm was the causative factor of poor outcome in patients with incidental and symptomatic aneurysms. Six of 15 cases of giant aneurysm had calcification in the aneurysmal wall and nine had no calcification. Although no intraoperative rupture was found in cases with calcification, two cases with no calcification suffered intraoperative rupture. Care should be taken to dissect giant aneurysms with no calcified wall. Rupture occurred in patients in clinically higher grades than in previously reported cases (we can only compare the clinical grade with one small series¹²⁾), but outcomes were equally favorable.

Paraclinoidal aneurysms can be clipped using meticulous and suitable surgical techniques with favorable results in all patients except those with giant aneurysm and associated basilar artery aneurysm.

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Commentary

The authors present an eleven-year experience by one surgeon in the management of sixty-eight patients with intradural paraclinoid aneurysms. Our experience with and approach to aneurysms of this region differs in several respects from the authors'. First of all, we avoid use of the term "paraclinoid."

This descriptive term is imprecise and fails to convey important anatomical information. Most aneurysms are named for the arterial branch with which they have the most intimate hemodynamic relationship. In keeping with traditional nomenclature we would refer to these lesions as ophthalmic segment aneurysms. Aneurysms on the ophthalmic segment of the internal carotid artery include ophthalmic artery aneurysms arising just distal to the origin of the ophthalmic artery and superior hypophyseal aneurysms arising at the origin of the superior hypophyseal arteries on the ventro-medial surface of the internal carotid artery. This is of more than academic interest as each of these aneurysms require different clip selection and clipping techniques.

Secondly, the large number of aneurysms treated by "coating" is of concern. We reserve coating or wrapping of aneurysms for those that are determined to be unclippable at the time of surgery. We hesitate to simply coat or wrap aneurysms in this region because of the questionable benefit on the natural history and because of the risk of the subsequent inflammatory reaction causing injury to the optic nerve.

Thirdly, the authors report that the anterior clinoid process was removed in only fifteen of the sixty-eight patients. It has been our experience that adequate exposure and clipping of aneurysms of the ophthalmic segment requires complete removal of the anterior clinoid process and opening of the dural ring. This fact may explain the low incidence of successful clip ligation in this series.

The authors utilized induced hypotension during clipping of aneurysms in this series. We have completely abandoned the use of hypotension during aneurysm surgery except in the unusual cases of deep hypothermic circulatory arrest. If an aneurysm is unable to be successfully clipped in its fully inflated state, we prefer the use of mild hypertension used in conjunction with temporary proximal clipping or trapping with brain protection utilizing barbiturates and mild hypothermia.

Finally, the authors report that two patient with "blister-like" aneurysms were trapped due to intraoperative rupture. These are extremely difficult aneurysms to treat. One should always be prepared to perform an extracranial to intracranial bypass if the vessel must be trapped. In most instances, the aneurysm can be reconstructed using a Sundt clip graft to encircle the involved segment of the carotid artery and maintain patency of its lumen.

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Miyazawa et al. reported their experience in treating 68 consecutive patients with paraclinoid aneurysms. They could achieve favorable outcome in 81% of the patients and concluded that paraclinoid aneurysms can be clipped with favorable results except for giant and associated basilar artery aneurysm. Aneurysms arising from the paraclinoid segment of the internal carotid artery (ICA) remain the most formidable and challenging lesion of the anterior circle of Willis. Because of the location in relation to the bony and neurovascular structures, proximal vascular control, adequate exposure, and neck dissection of paraclinoid aneurysms are often extremely demanding. For critical dissection of paraclinoid aneurysms and clip placement, we routinely use temporary clip on the ICA proximal and distal to the aneurysm under normotension and barbiturate brain protection. The site of proximal control would be the intracranial ICA after removal of the anterior clinoid process or extracranial ICA in the neck. Use of a microvascular Doppler probe and intraoperative angiography after clip placement would be necessary to detect compromised blood flow and to confirm isolation of an aneurysm from the parent artery. For blister-like aneurysm of the ICA, we use the "wrapping and clipping" technique: encircle the ICA including the "blister" with a piece of cellulose sheet, hold both ends of the sheet and pull toward the surgeon, and at the same time, place an angled clip over the sheet including aneurysm with slight pushing against the ICA. If a noncontrast computerized brain scan demonstrates calcification of the aneurysm neck, intra-aneurysmal treatment with Guglielmi detachable coil would be the choice of treatment.

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The authors summarize a single-center surgical experience of 68 patients with intradural paraclinoid aneurysms. Their operative results and analysis are good. In this paper, they concluded that paraclinoid aneurysms can be clipped with favorable results using modern microsurgical techniques except for giant aneurysms and associated basilar artery aneurysms. I agree with the authors that giant paraclinoid aneurysms are still a challenge to most neurosurgeons. In my experience, the retrograde suction decompression technique is extremely effective for surgical treatment of large and giant paraclinoid aneurysms. However, even when the aneurysm is completely deflated, basic surgical procedures for treatment of aneurysms in this location, such as extensive removal of the anterior clinoid process,

sufficient exposure of the carotid dural ring and multiple clipping technique are still essential.

With the experience of retrograde suction decompression method, we found an interesting phenomenon. That is, while monitoring the carotid stump pressure by means of a catheter placed in the cervical internal carotid artery (ICA), proximal cervical ICA occlusion resulted in a sudden decrease in stump pressure to about 50% of the pre-occlusion level; but subsequent occlusion of the intracranial ICA (distal occlusion) resulted in an increase in stump pressure to a level above the pre-occlusion level. This finding indicates that when an aneurysm is incompletely trapped, intra-aneurysmal pressure can be elevated by the retrograde flow through the small remaining branches. Even in cases where the ophthalmic artery, PcomA and anterior choroidal artery have been occluded, similar increases in stump pressure are observed, suggesting the notable participation of retrograde flow from the cavernous ICA branches involving the meningohypophyseal trunk. To my knowledge, this paradoxical phenomenon has not been reported previously. In this paper, the authors suggest that proximal control with intermittent temporary occlusion of the cervical ICA is helpful for dissection of giant aneurysms, and that temporary trapping might be needed when cervical ICA interruption fails to achieve an adequate decrease of intra-aneurysmal pressure. However, it must be emphasized that simple trapping by cervical ICA clamping and intracranial distal clipping does not adequately soften the large aneurysm because of a brisk retrograde flow through the ophthalmic artery and cavernous branches. This phenomenon also implies that the risk of aneurysmal rupture may increase

following such a simple trapping as a result of paradoxical rise in the intra-aneurysmal pressure. In my opinion, it is essential to use the retrograde suction technique when the aneurysm is temporarily trapped.

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The authors report the result of surgical treatment of intradural paraclinoid aneurysms which include so-called berry type and blister-like aneurysms. From the view point of treatment strategy, we have to recognize that blister-like aneurysm has different and difficult problems compared to berry type aneurysm of this region; for instance high incidence of premature rupture and special clipping technique needed such as clipping on wrapping method and so on. When aneurysms are located fully in the intradural space, the operative difficulty corresponds to aneurysm size such as large or giant aneurysm and surgical results are determined by the preoperative clinical grade of the patients as mentioned by the authors. Though they do not discuss the precise location of the aneurysm, one of the difficulties of surgical treatment of the intradural aneurysm in this area is how to preoperatively evaluate the extension of the neck to carotid dural ring or not. I concur with these results of surgical treatment for intradural paraclinoid aneurysms except for the efficacy of coating for blister-like aneurysms.

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