<招待講演 II>

Surgery of Anterior Communicating Artery Aneurysms with Special Reference to Surgical Anatomy

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Abstract

We experienced 367 anterior communicating artery aneurysms (ACOAA) in 360 patients out of 1088 cerebral aneurysms operated on during recent 14 years. Three hundred and thirty three cases presented with subarachnoid hemorrhage, while the other 27 cases with unruptured ACOAA were detected during angiography for other ruptured aneurysm or other disease.

The most common direction of ACOAA was anterior (39%), followed by superior, inferior, and posterior. The size of ACOAA was less than 10 mm in 303 (82/6%), between 11 mm and 24 mm in 59 (16.1%), and giant type in 5 (1.3%). Intraoperatively we found abnormalities of anterior communicating artery (ACOA) complex frequently. The vascular anomalies of ACOA complex were classified into four categories: anomalies of the A₁, the ACOA, the A₂, and the recurrent artery of Heubner. In 360 cases of ACOAA, A₁ anomaly was the most common. Hypoplasia of A₁ was observed in 58 cases (16.1%), aplasia of A₁ in 15 cases (4.2%), and fenestration of A₁ in 2 cases (0.6%). Duplication of ACOCA was present in 8 cases (2.2%), triplication of ACOA in 2 cases (0.6%), and fenestration/plexiform of ACOA in 25 cases (6.9%). Unpaired A₂ was shown in 4 cases (1.1%), triplication of A₂ in 9 cases (2.5%), and frontal branch from A₁ in 2 cases (0.6%). The only anomaly of recurrent artery of Heubner was duplication, which was present in 10 cases (2.8%).

In conclusion, for the successful surgery of ACOAA, we must take these anomalies into consideration in planning the surgical strategy.

Key words: anterior communicating artery aneurysm, vascular anomaly, giant aneurysm, fenestration, duplication

Introduction

It has been suggested that vascular anomalies of the circle of Willis with hemodynamic abnormalities are frequently associated with aneurysms¹⁾⁷⁾¹³⁾¹⁴⁾¹⁷⁾. Anterior communicating artery aneurysm (ACOAA) is the most common type identified in adult clinical series and account for 40 to 50 percent of intracranial aneurysms in male patients^{2)4)~6)10)16)}, which is associated with vascular anomalies frequently.

In this study, we analyzed our experience of surgery for ACOAA during the past 14 years, with special reference to the vascular anomalies around the aneurysm and comment on the effectiveness of operative methods.

Clinical Material and Methods

From 1982 to 1995, 1088 intracranial aneurysms were operated on in our institute. Among them, 367 aneurysms were located at the anterior communicating artery (ACOA) in 360 patients, with 7 patients having 2 aneurysms at the ACOA (Table 1). In most of our series, the surgical approach for

Table 1 Locations of operated Aneurysms

Location	No.(%)
Internal Carotid Artery	327(30.1%)
Anterior Cerebral Artery	421(38.7%)
A ₁	14(1.3%)
ACOA	367(33.7%)
distal ACA	40(3.7%)
Middle Cerebral Artery	242(22.2%)
Posterior Circulation	98(9%)
Total	1,088

Table 2 Distribution of preoperative Hunt-Hess grade and outcome

Preop Grade	Operative Result					Total Cases
	GR	MD	SD	V	D	
I	78	7	2	0	5	92
II	93	20	8	2	7	130
III	34	21	9	6	11	81
IV	4	4	10	3	4	25
V	0	0	1	1	3	5
Total	209	52	30	12	30	333

*GR=good recovery, MD=moderately disabled

SD=severely disabled, V=vegetative, D=dead

this location was performed through the standard pterional route, which offers enough room for observation of the vascular anatomy around the ACOA complex.

For analysis, we reviewed the clinical and the angiographic factors of these patients retrospectively, including their age, sex, preoperative status, surgical timing, surgical modalities, surgical outcome, direction of aneurysm, size of aneurysm and combined vascular anomalies. The direction of aneurysm, which was determined by the angiography, were classified into the anterior, the posterior, the superior and the inferior. The size of aneurysm was determined by the longest diameter, which was measured by angiography or the surgeon's estimate in cases with thrombosed portions of aneurysmal sac.

In this study, the type of vascular anomalies of the ACOA complex were determined on the basis of the operative findings. These vascular anomalies were categorized as follows: anomalies of the A₁, the ACOA, the A₂, and the recurrent artery of Heubner. The Hunt and Hess classification was used for evaluating the patients' preoperative condition. For evaluation of the operative results, Glasgow outcome scale was utilized.

Results

Clinical profiles of ACOAA

The age distribution of the patients was from 13 to 90 years old with the mean age of 48.7. The male to female ratio was 5 to 4. In male, most patients were in the fifth decade, while in female most cases were in the sixth decade. In 7 cases, there were 2 aneurysms at the ACOCA complex.

Table 2 shows the distribution of preoperative Hunt and Hess grade and surgical outcome in 333 cases with ruptured ACOAA. This table demonstrates the tendency of poor surgical outcome in patients with poor preoperative Hunt and Hess grade.

The most common direction of ACOAA was the anterior 143 (39%), followed by the superior 115 (31%), the inferior 74 (20%), and the posterior 35 (10%). The size of ACOAA was less than 10 mm in 303 cases (82.6%), between 11 mm and 24 mm in 59 (16.1%), and giant in 5 (1.3%). Regarding surgical timing with reference to the time of aneurysmal rupture, 23 cases (6.9%) were operated on within 24 hours, 84 cases (25.2%) between the second and the fourth day, 102 cases (30.7%) between the fifth and the fourteenth day, and the other 124 cases (37.2%) after 14 days. The most common reason for the delay of operation was the delayed transportation of the patients from the other hospitals. In most cases, the aneurysmal neck could be clipped (95.4%), and there were 7 cases (1.9%) treated by the trapping of the ACOA, and 8 cases (2.2%) by wrapping.

Anomalies combined with ACOAA

Intraoperatively we found abnormalities of ACOA complex frequently. The vascular anomalies

Table 3 Vascular anomalies in the vicinity of ACOAA

	A ₁	ACOA	A ₂	RAH*
Hypoplasia	58(16.1%)			
Aplasia	15(4.2%)			
Fenestration/Plexiform	2(0.6%)	25(6.9%)		
Unpaired			4(1.1%)	
Duplication		8(2.2%)		10(2.8%)
Triplication		2(0.6%)	9(2.5%)	
Frontal Br. from A1			2(0.6%)	

*Recurrent artery of Heubner

of ACOA complex were divided into four categories (Table 3): such as anomalies of the A₁, the ACOA, the A₂, and recurrent artery of Heubner. In 360 cases of ACOAA, A₁ anomaly was the most common. Hypoplasia of A₁ was observed in 58 cases (16.1%), aplasia of A₁ in 15 cases (4.2%), and fenestration of A₁ in 2 cases (0.6%). In ACOA anomaly, duplication of ACOA was present in 8 cases (2.2%), triplication of ACOA in 2 cases (0.6%). Fenestration/plexiform of ACOA is the most common type of anomaly in ACOA. We found it in 25 cases (6.9%). Regarding A₂, unpaired type was shown in 4 cases (1.1%) and triplication of A₂ in 9 cases (2.5%). Frontal branch from A₁ was found in 2 cases (0.6%). The only anomaly of recurrent artery of Heubner was duplication, which was present in 10 cases (2.8%).

Discussion

In the surgery for aneurysms at the anterior communicating artery, variations of vascular anatomy are encountered very frequently. There have been many reports about this point, and according to the method of analysis and materials, various categories of anomalies have been reported⁷⁾¹¹⁾¹²⁾¹⁹⁾. In this study, we analyzed the vascular anomalies observed under operating microscope during surgery, except asymmetry of H-complex which is very common.

In literature, the A₁ hypoplasia and the A₂ aplasia are reported in the frequency of between 8% and 85%, between 1% and 2% respectively⁸⁾⁹⁾¹⁵⁾¹⁹⁾. In our series, we found relatively low frequency of hypoplasia (16.1%) and high incidence of aplasia (4.2%). In some series, duplication of A₁ was reported but we had no such a case. With respect to ACOA anomalies, 9.7% of ACOA were anomalous (duplication, triplication or fenestration/plexiform type) in our series, which is comparable to other reports on operative cases (5.7%-40.3%)⁷⁾¹¹⁾¹⁹⁾. We had no experience of ACOA aplasia which has been reported in the range of frequency from 0.2% to 1%³⁾¹⁸⁾¹⁹⁾.

Figure 1 shows the types of giant aneurysms in our ACOAA series. In case 1 and 2, right A₁ was hypoplastic but there was aplastic A₁ in case 3 and 5. In case 4, there was agenesis of internal carotid artery. All of these giant aneurysms were clippable. And this data suggest relatively high incidence of combined anomaly in giant ACOAA. Figure 2 shows the fenestration of A₁. In case 3 which was not included in our ACOAA series, the A₁ artery has long and prominent fenestration with A₁ aneurysm.

In most cases, we utilized pterional approach, which provided with enough space to dissect around the aneurysms and identify vascular anatomy around the ACOA complex. This approach seems to offer more room for operation compared with the subfrontal interhemispheric approach.

In our experience, preoperative prediction of these anomalies by angiography was difficult or impossible, as has been reported by other authors¹¹⁾. In the preoperative angiogram, all types of vascular anomalies around the ACOA complex revealed only a "complicated configuration of vessels".

Fig. 1 Schematic drawings demonstrating the giant types of anterior communicating artery aneurysms.

Fig. 2 Illustrations showing the fenestration of A_1 artery in 3 cases with anterior communicating artery aneurysms or A_1 artery aneurysms.

In conclusion, various vascular anomalies are commonly associated with ACOAA. Therefore, for the successful surgery of ACOAA, we must take these anomalies into consideration in planning the surgical strategy, especially when the image of preoperative angiography looks complicated around the ACOA complex.

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