CLINICAL ARTICLE

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Intracranial Aneurysms in the 3rd and 4th Decades in Comparison with Those in the 8th and 9th Decades

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Objective : This study is performed to compare older with younger groups about clinical characteristics and overall outcome of treatments for the intracranial aneurysms.

Methods : We retrospectively investigated 633 patients with cerebral aneurysms who were admitted to our institute from January 2000 to May 2004. The authors divided the patients of cerebral aneurysm into two groups, one the third, fourth decades and the other eighth, ninth decades, analyzed clinical characteristics and overall outcome of treatments.

Results : There were 57 patients (9.0%) under 39years old and 58 patients (9.2%) over 70. The female to male sex ratio was 0.5 : 1 in the younger group(YG) and 7.3 : 1 in the older group(OG), showing a female predominance with increasing age. In the YG, aneurysms were found in anterior communicating artery(A-com) (44.8%), middle cerebral artery (31.0%). In the OG, aneurysm of posterior communicating artery (30.1%) was most common followed by that of A-com (26.9%). More smokers and alcoholics were found in the YG. Older age was related to poor Hunt-Hess grade, Fisher' s grade on admission, high incidence of unruptured aneurysms, and endovascular surgery. There was a higher prevalence of hypertension, intraventricular hematoma, hydrocephalus, and rebleeding in the preoperative state in the OG and postoperative complications including hydrocephalus, subdural fluid collection, and systemic complications. Overall outcome was poorer with advancing age (p=0.01).

Conclusion : The patients with aneurysms in the YG have distinct characteristics compared to those in the OG. Because of a good clinical grade on admission, a thin subarachnoid clot, and low incidence of perioperative complications, the overall outcomes of the young patients were better than those of the old patients.

KEY WORDS : Cerebral aneurysm · Age · Clinical analysis · Prognosis.

Introduction

Aneurysmal subarachnoid hemorrhage(SAH) is an uncommon disease in young and old adults. Clinical characteristics of cerebral aneurysms in the peak age group (40~60years) have been studied a lot, those of 3rd, 4th decades and 8th, 9th decades were not studied as much[7,13,16,20,23]. And there were few studies of the two groups in the aneurysm patients[3,8,15,17]. We undertook a study of a series of patients in the 3rd, 4th decades and 8th, 9th decades who were treated for cerebral aneurysms in our hospital. Authors compared the two groups for the clinical features of these lesions and overall outcome of treatments.

Materials and Methods

Patient selection

Between January 2000 and May 2004, 633patients with intracranial aneurysms received surgical treatment in our institute. The authors divided the patients with cerebral aneurysm into the two groups, one the 3rd, 4th decades (younger group, YG) and the other the 8th, 9th decades (older group, OG). Clinical data and the imaging findings of 57patients under 39years old and 58patients over 70 were reviewed. Patients with traumatic or mycotic aneurysms were excluded from this study. We retrospectively compared the clinical characteristics of two groups including Hunt-

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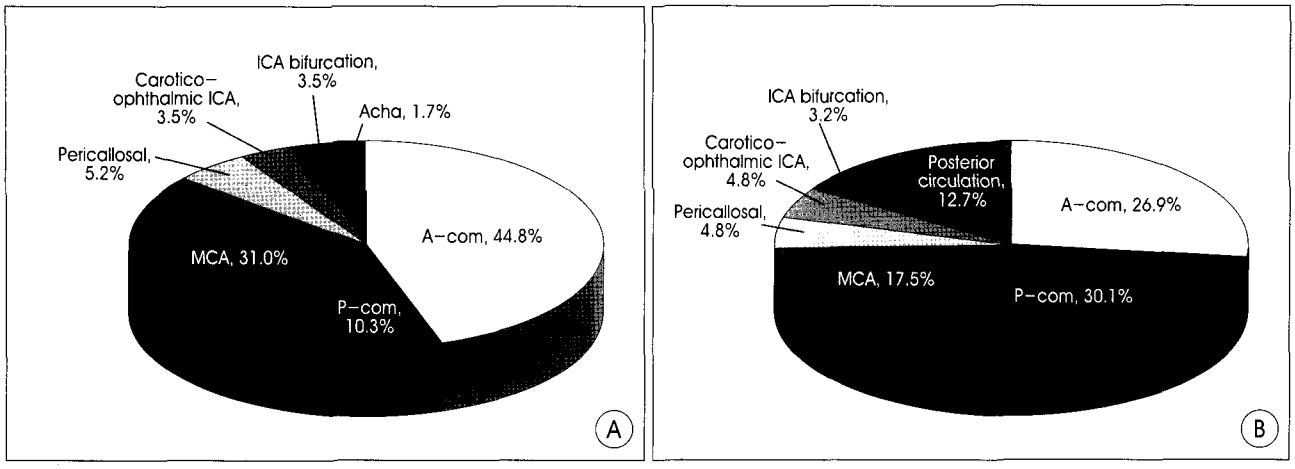

Fig. 1. Site of aneurysms of the younger and elderly groups with aneurysmal subarachnoid hemorrhage, A-com = anterior communicating artery ; P-com = posterior communicating artery ; MCA = middle meningeal artery ; ICA = internal carotid artery ; Acha = anterior choroidal artery.

Hess grade, Fisher grade, and type, size, location of aneurysms and the results of treatment. We also reviewed preexisting medical conditions, clinical courses, perioperative complications, total cholesterol level, and history of smoking and alcohol as baseline factors. The size of the aneurysms was determined by measuring their maximal inner diameter on each angiography. The aneurysms were divided into four groups based on the size of their diameters : small, less than 6mm; medium, between 6 and 15mm; large, between 16 and 25mm; and giant, more than 25mm. Neurological outcome was assessed during the last follow up visit using the Glasgow Outcome Scale(GOS). According to this scale, outcome is divided into five categories : good recovery(GR), moderate disability(MD), severe disability(SD), persistent vegetative state(V), and death(D). Timing of surgery was divided into the early and delayed. We defined it as early surgery when direct clipping or Guglielmi Detachable Coil (GDC) embolization was done within 3days after SAH.

Postoperative follow-up duration ranged from 1 to 36months (mean, 8.5months) in the YG and 0 to 35months (mean, 7.3months) in the OG.

Statistical analysis

The data was expressed as mean values. For the statistical comparison, we performed a Student unpaired t-test, and chi-square test using SPSS 10.0 for window. In all cases, differences in p values of less than 0.05 were considered to be statistically significant.

Results

Age and sex distribution

During the 4-year period from January 2000 to May 2004, 633patients were treated in our institute. Among the 633 patients, there were 57patients (9.0% of total patients) in the 3rd, 4th decades (mean 35.2years) and 58patients (9.2%) in the 8th, 9th decades (mean 74years). The youngest patient was 21years old, and the oldest patient was 84years old. The baseline characteristics of the patient population by age group are summarized in Table 1. The female to male sex ratio was 0.5 : 1 in the YG while 7.3 : 1 in the OG. Sex ratio was significantly different between the two groups ($p<0.01$).

Location, type, and size of aneurysms

Fig. 1 shows the percentage of aneurysmal location in the two age groups. The distribution of aneurysmal location was quite different between the two groups ($p=0.00$). In the YG, we found aneurysms arising from the anterior communicating artery(A-com) in 26cases (44.8%), while in 18cases (31.0%) the aneurysms were located on the middle cerebral artery (MCA). In only 6cases (10.3%) aneurysms were located on the posterior communicating artery (P-com). We did not find any cases of posterior circulation aneurysms (Fig. 1A). In the OG, we found aneurysms arising from the P-com in 19cases (30.1%), from A-com in 17cases (26.9%) and from the MCA in 11cases (17.5%). And, aneurysms were found on the posterior circulation arteries (8cases; 12.7%, Fig. 1B).

In the only 1case (1.8%) in the YG, we found two aneurysms, ruptured one located on the P-com and the unruptured one on the MCA. The younger adult with multiple aneurysms also suffered from systemic arterial hypertension. In the OG, 8.6% of patients (5cases) had multiple aneurysms. But the multiplicity of aneurysms was not significantly different between the two groups ($p=0.09$).

In the YG, 57 aneurysms (98.3%) were ruptured and 1 aneurysm (1.7%) was unruptured. In the OG, 55 aneurysms (87.3%) were ruptured and 8 aneurysms (12.7%) were unruptured. The type of aneurysms differed significantly in the two groups ($p=0.02$).

Table 1. *Baseline clinical characteristics of the younger and elderly groups with aneurysmal suba-rachnoid hemorrhage*

Clinical characteristics	No. of patients(%)		p Value
	Age<40	≧70	
Sex			<0.01
Men	37(64.9)	7(12.1)	
Women	20(35.1)	51(87.9)	
Hunt-Hess grade			0.01
I, II	34(59.6)	28(48.3)	
III	20(35.1)	16(27.6)	
IV, V	3(5.3)	14(24.1)	
Fisher grade			0.01
1, 2	33(57.9)	19(32.8)	
3	16(28.1)	17(29.3)	
4	8(14.0)	22(37.9)	
Type			0.02
Ruptured	57(98.3)	55(87.3)	
Unruptured	1(1.7)	8(12.7)	
Size			0.85
Small	44(75.9)	44(69.8)	
Medium	10(17.2)	15(23.8)	
Large	3(5.2)	3(4.8)	
Giant	1(1.7)	1(1.6)	
Multiplicity	1(1.8)	5(8.6)	0.09

Table 2. *Smoking, alcohol, and total cholesterol lelve of the younger and elderly groups with aneurysmal subarachnoid hemorrhage*

Factor	No. of patients(%)		p Value
	Age<40	≧70	
Smoking			<0.01
Smoker	31(54.4)	9(15.5)	
Non-smoker	26(45.6)	49(84.5)	
Alcohol			<0.01
Alcoholics	37(65.0)	19(32.8)	
Non-alcoholics	20(35.0)	39(67.2)	
Total cholesterol			0.22
≧200mg/dl	12(21.1)	18(31.0)	
<200mg/dl	45(78.9)	40(69.0)	

In the YG, we found small sized 44 aneurysms (75.9%), medium, 10 (17.2%), large, 3 (5.2%), and giant, 1 (1.7%). In the OG, we observed small sized 44 aneurysms (69.8%), medium, 15 (23.8%), large, 3 (4.8%), and giant, 1 (1.6%) (Table 1). Age was not significantly associated with aneurysmal size (p=0.85).

Smoking, alcohol, and total cholesterol level

Thirty-one patients (54.4%) in the YG have been smoking while 26patients (45.6%) have never smoked. 9cases (15.5%) in the OG were smokers, while 49cases (84.5%) were non-smokers.

Thirty-seven patients (65.0%) in the YG were alcoholics and 20 patients (35.0%) were non-alcoholics while 19 patients (32.8%) in the OG were alcoholics, and 39patients (67.2%) have not been drinking.

We compared total cholesterol level between the two groups. There were 12cases (21.1%) with more than 200mg/dl of total cholesterol level in the YG and 18cases (31.0%) in the OG. Forty-five patients (78.9%) in the YG and 40patients (69.0%) in the OG were less than 200 mg/dl (Table 2).

Habits of smoking and alcohol were quite different between the two groups (both $p<0.01$), but total cholesterol level did not differ significantly (p=0.22).

Table 3. *Clinical course of the younger and elderly groups with aneurysmal subarachnoid hemorrhage*

Clinical course	No. of patients(%)		p Value
	Age<40	≧70	
Treatment			<0.01
Operation	52(91.2)	39(67.2)	
GDC*	2(3.5)	14(24.1)	
Operation+GDC	2(3.5)	1(1.7)	
Conservative	1(1.8)	4(7.0)	
Timing of surgery			0.35
Early surgery	35(61.4)	29(50.0)	
Delayed surgery	21(36.8)	25(43.1)	
ICU*stay period(day)	8.5	11.7	0.08

* GDC = Guglielmi detachable coil ; ICU = intensive care unit

Neurological state and finding on computerized tomography(CT) scans on admission

On admission the Hunt and Hess grade in the two groups was evaluated as Table 1. In the YG, we classed 34patients (59.6%) as grade I, II, 20patients (35.1%) as grade III, and 3patients (5.3%) as grade IV, V. In the OG, grade I, II were observed in 28patients (48.3%), grade III in 16patients (27.6%), grade IV, V in 14patients (24.1%). A strong association between age and level of consciousness on admission (p=0.01) was noted.

And the Fisher's grade on admission in the two groups was evaluated as Table 1. In the YG, we classed 33patients (57.9%) as grade 1, 2, 16patients (28.1%) as grade 3, and 8patients (14.0%) as grade 4. In the OG, grade 1, 2 were observed in 19 patients (32.8%), grade 3 in 17patients (29.3%), grade 4 in 22patients (37.9%). Older patients were more likely to have a thick subarachnoid clot than younger patients (p=0.01).

Clinical course

Thirty-five patients (61.4%) in the YG were treated with early surgery and 29patients (50.0%) in the OG were operated within 3days. Twenty-one patients (36.8%) in the YG were treated with early surgery and 25patients (43.1%) in the OG were operated 3days after SAH.

Table 4. Preoperative systemic and intracranial complications of the younger and elderly groups with aneurysmal subarachnoid hemorrhage

Preoperative condition	No. of patients(%)	
	Age<40	≧70
Systemic condition	12(21.1)	35(60.3)
Hypertension	11(19.3)	21(36.2)
Diabetes mellitus	1(1.8)	5(8.6)
Pulmonary disease	0(0)	3(5.2)
Cerebrovascular disease	0(0)	2(3.4)
Cardiac disease	0(0)	2(3.4)
Colorectal cancer	0(0)	1(1.8)
Thyroid disease	0(0)	1(1.8)
Intracranial complication	11(19.3)	37(63.8)
Hydrocephalus	4(7.0)	14(24.1)
Intracerebral hemorrhage	4(7.0)	6(10.3)
Intraventricular hemorrhage	0(0)	8(13.8)
Rebleeding	1(1.8)	7(12.1)
Ptosis	1(1.8)	2(3.4)
Vasospasm	1(1.8)	0(0)

Table 5. Postoperative intracranial and systemic complications of the younger and elderly groups with aneurysmal subarachnoid hemorrhage

Post operative complication	No. of patients(%)	
	Age<40	≧70
Intracranial complication	24(42.1)	48(82.8)
Vasospasm	14(24.6)	3(5.2)
Hydrocephalus	4(7.0)	25(43.1)
Hemorrhage	2(3.5)	0(0)
Infection	2(3.5)	4(6.8)
Hygroma	1(1.8)	10(17.2)
Ptosis	1(1.8)	2(3.4)
Dementia	0(0)	2(3.4)
CSF leakage	0(0)	2(3.4)
Systemic complication	6(10.5)	18(31.0)
Hyponatremia	2(3.5)	6(10.3)
Cardiac decompensation	2(3.5)	5(8.6)
Urinary tract infection	1(1.8)	1(1.7)
Pleural effusion	1(1.8)	0(0)
Pneumonia	0(0)	3(5.2)
Hypernatremia	0(0)	1(1.7)
Hyperglycemia	0(0)	1(1.7)
Hematemesis	0(0)	1(1.7)

In the YG 52patients (91.2%) were operated with direct clipping, 2cases (3.5%) with GDC embolizaton, 2cases (3.5%) with GDC embolizaton after direct clipping, and 1case (1.8%) was treated with conservative treatment. In the OG 39patients (67.2%) were operated with direct clipping, 14cases (24.1%) with GDC embolizaton, 1case (1.7%) with GDC embolizaton after direct clipping, and 4cases (7.0%) were treated conservatively.

In the YG, ICU admission period ranged from 1 to 26days (mean, 8.5days) while patients of the OG were admitted from 0 to 82days (mean, 11.7days) (Table 3). Modality of treatment was significantly different ($p<0.01$), but timing of surgery and ICU stay period did not differ between the two groups (each p=0.35, 0.08).

Preoperative intracranial and systemic conditions

Eleven cases (19.3%) in the YG had preoperative intracranial conditions such as hydrocephalus requiring a shunting operation (7.0%), intracerebral hemorrhage (ICH, 8.6%), vasospasm, rebleeding, ptosis. While 37patients (63.8%) in the OG had intracranial conditions in the preoperative state including hydrocephalus (24.1%), intraventricular hemorrhage (IVH, 13.8%), ICH, rebleeding, ptosis. No case of vasospasm was found in the preoperative state. The OG had more preexisting medical problems and preooperative intracranial complications significantly than those in the YG (both $p<0.01$).

Twelve patients (21.1%) in the YG had preexisting systemic conditions including hypertension (19.3%), diabetes mellitus (DM) (1.8%). In the OG, 35patients (60.3%) had preexisting systemic conditions including hypertension (36.2%), DM (8.6%), pulmonary disease, cerebrovascular disease, cardiac disease, thyroid disease, colorectal cancer (Table 4).

Postoperative intracranial and systemic complications

Intracranial and systemic complications were observed in many patients, and the incidence and the types of associated pathology in each group are shown in Table 5.

Twenty-four patients (42.1%) in the YG had postoperative intracranial complications including vasospasm (24.6%), hydrocephalus (7.0%), hemorrhage, infection, hygroma, and ptosis while there were 48patients (82.8%) in the OG including hydrocephalus (43.1%), subdural hygroma (17.2%), infection, vasospasm, ptosis, dementia, and CSF leakage.

Six cases (10.5%) in the YG had postoperative systemic complications such as hyponatremia (3.5%), cardiac decompensation (3.5%), urinary tract infection(UTI). pleural effusion. While 18 patients (31.0%) in the OG had systemic complications in the postoperative state including hynonatremia (10.3%), cardiac decompensation (8.6%), pneumonia, UTI, hypernatremia, hyperglycemia, and hematemesis. More postoperative intracranial and systemic complications existed in the OG than in the YG.

Overall outcome of treatments

In the YG, a favorable outcome (GR, MD according to GOS) was obtained in 56cases (98.2%); GR, 49.1%; MD, 49.1%, and a unfavorable outcome (SD, V, D) was observed in 1 case (1.8%); SD, 1.8%. In the OG, a favorable outcome

Table 6. Outcome during last follow up visit of the younger and elderly groups with aneurysmal subarachnoid hemorrhage

Glasgow outcome scale	No. of patients(%)		p Value
	Age<40	≧70	
Favorable	56(98.2)	47(81.0)	
Good recovery	28(49.1)	15(25.8)	
Moderate disability	28(49.1)	32(55.2)	
Unfavorable	1(1.8)	11(19.0)	0.01
Severe disability	1(1.8)	7(12.1)	
Vegetative	0	3(5.2)	
Dead	0	1(1.7)	

was obtained in 47 cases (81.0%); GR, 25.8%; MD, 55.2%, and a unfavorable outcome was observed in 11 cases (19.0%); SD, 12.1%; V, 5.2%; D, 1.7% (Table 6). In our series the treatment outcome was significantly better in the YG than in the OG (p=0.01).

Discussion

Cerebral aneurysms, both ruptured and unruptured, most frequently occur in patients between 40 and 60 years. The incidence of aneurysms on the 3rd, 4th decadess and 8th, 9th decades is rather low compared to those on the peak age[8,13,16,17]. In the study of Kamitani et al.[7] it constitutes 11.8% in the YG, 8.7% in the OG of all aneurysms cases and Osawa et al.[15] reported each 5.7%, 19.1%. But, the incidence is expected to increase because many factors affect aneurysm growth and rupture in the YG and more and more people live to their 8th, 9th decades[22]. Aneurysmal SAH under 39 and over 70years old increases to become a more important problem.

Analysis of previously reported cases indicates some distinct characteristics that distinguish aneurysms in young adults from those occurring in old adults[3,5,7,9,13-18,20,21,23]. Many authors have noted the male predominance in the YG, in contrast to the female predominance in the OG[7,9,13,18,23]. In the present study, the female to male sex ratio was 0.5 : 1 in the YG while 7.3 : 1 in the OG. It is well known that cerebral aneurysm formation and rupture have been associtated with increased aging, female sex, and smoking[14]. The female predominance in older adults with aneurysm may be connected to menopause in this group. The decreased level of estrogen results in a decrease of collagen, which plays an important part in maintaining the strength of the vessel wall[9]. Also the increased incidence of aneurysms with age in women has been related to smoking[1]. In contrast to previous report[1], we found that non-smokers were dominant significantly in the OG with female predominance ($p<0.01$). We also noted that there was a strong association between smoking, alcohol and younger patients with aneurysmal SAH than older patients. It is important that the health behavior such as smoking, alcohol should be changed because aneurysmal SAH may be largely a preventable disease in case of young adults, although the role of alcohol is not known in the aneurysm[2].

In the 3rd, 4th decades, we found that most of the aneurysms arose form the A-com (44.8%) and the MCA (31.0%), and only in 10.3% from the P-com. In the study of other authors[4,16], the common localization of aneurysms on the A-com and on the bifurcation of the internal carotid artery (ICA) has been observed in the YG, and an appreciable number of MCA aneurysms was noted. We did not find posterior circulation aneurysms in this group. Gerosa et al.[4] also found no posterior circulation aneurysms. Meyer et al.[13] however, showed that aneurysms in adolescents tended to be located in the posterior circulation. In our study, in contrast to the YG, the incidence of posterior circulation aneurysms in the OG was very high (12.7%).

These locations and frequency are very different from those in the 8th, 9th decades. In the OG, we found that lots of aneurysms arose form the P-com (30.1%) and the A-com (26.9%), and only in 17.5% from the MCA. P-com aneurysms were frequently observed in patients in the OG. In other words, during the 8th, 9th decades, aneurysms tend to be located more proximally along the cerebrovascular tree. We supposed aging factors including hypertension and atherosclerosis induce excessive hemodymic stress and it may be one reason for aneurysm formation and rupture at the ICA. In the case of patients over 70, our study showed aneurysms at sites were similar to those previously reported[8]. But Sakaki et al.[20] found that A-com aneurysms occurred more frequently and ICA aneurysms less often in older patients.

Controversy exists concerning whether there is a difference in the location of aneurysms among age groups and the causes of these differences are still uncertain.

We found only 1case (1.8%) of multiple aneurysms in the YG and 5cases (8.6%) in the OG. Compared with the OG, the incidence of multiple aneurysms was lower in the YG. However, it was not sifgnificantly different in our study (p=0.09). Ostergaard et al.[16] reported only 4patients had diagnosed arterial hypertension before admission and three of them had multiple aneurysms. Our study also showed that one patient in the fourth decade of life with hypertension had multiple aneurysms. Kamitani et al.[7] supposed aneurysms in young adult increase in number as they grow older and might have been increasing sufficiently in size to rupture in the forties and fifties. In our study, aneurysms were not larger significantly in patients in the OG than those in patients in the YG (p=0.85). But, Kamitami et al.[7] have proposed that cerebral aneurysms may be formed during childhood and adolescence, and may increase in size, later rupturing when

the patient attains adulthood, depending on aging factors including hypertension and atherosclerosis.

In this study, there were more preexsiting medical problems significantly in the OG than those in the YG. Patients with aneurysms exhibited hypertension at an incidence rate of 19.3% in the YG, 36.2% in the OG (p=0.04). Kamitani et al[7] reported each 13.3%, and about 61.4% respectively. Although there was some differences between the two studies, patients in the OG exhibited hypertension at significantly higher rates. It is well known that the formation and rupture of aneurysms seems to depend on an imbalance between arterial durability and hemodynamic stress. Some authors[16] emphasized intrinsic factors as being of the great importance in the formation and rupture of juvenile aneurysms and the others[7] have suggested aneurysm formation may be influenced by factors such as hypertension and atherosclerosis. In the study of Korea medical insurance corporation(KMIC), the prevalence of hypertension was 28.9% in men and 15.9% in women in the general population and it increased with advancing age[6]. The incidence of hypertension between the two groups in our study was not different significantly from those in KMIC. This fact supports other authors have been debating whether hypertension plays an important role in aneurysm formation and rupture[11,21,22].

In our study, the significant difference in timing of surgery did not exist (p=0.35), however, the number of older patients operated on early surgery in the present study was relatively low (YG:OG = 61%:50%). We supposed that the incidence of early surgery in the OG was lower than expected because of associated serious medical problems and a poor neurological condition on admission. Early surgery is recommended because of better tolerance of surgery in young adults[16,18] and is supported in older patients because the rebleeding rate increases with advancing age and older people are more likely to experience IVH and acute hydrocephalus[8]. In the present study, rebleeding occurred in 1case (1.8%) in the YG, 7cases (12.1%) in the OG and there was a significant difference between the two groups (p=0.03). And there was a higher incidence of IVH, acute hydrocephalus in the OG. Improvements in microsurgical and neuroanesthesiological techniques have resulted in an increasing number of surgery for aneurysms in the acute stage even in elderly patients. In a recent retrospective analysis, Fridriksson et al. reported surgery yielded good results in two-thirds of 76patients aged to 70~74years and this figure approached the results of aneurysm treatment in the YG[3]. Surgery was, in many cases, refused to the "elderly" because of age. However, patients who are neurologically intact after SAH are potential candidates for early surgical treatment. Besides, in medically unstable patients or in the presence of serious associated risk factors, endovascular therapy represented a valid alternative to surgical exclusion of the aneurysm. Also, in our study, GDC embolization was much more done significantly in the OG than those in the YG.

The overall management results of patients with aneurysmal SAH have steadily improved through a variety of achievements. However, outcomes of aneurysmal SAH among young adult patients have generally been more favorable than old adult patients[3,7,12,16,18,19,23]. The reversibility of neural injury in young patients and the low incidence of hydrocephalus in this age group could be the explanation for this[14,16,18], and it may be related to the small volume of the subarachnoid hematoma as shown by Pasqualin[18]. In our material 3% of the YG admitted were classed as grade IV and V according to the Hunt-Hess scale and 34% of patients were in a good neurological state (grade I and II on the Hunt-Hess scale). In the OG, the corresponding proportions were, respectively, 14%, and about 28%. More older patients than younger patients were in a poor neurological condition at the time of admission. In the study of Ostergaard et al.[16] 58% of children and adolescents admitted were classed as grade I and II according to the Glasgow Coma Scale(GCS). Fridriksson et al.[3] showed 23.6% of patients in the OG were in a poor neurological state. In our series, the clinical outcome also appeared to be significantly better in the YG than those in the EG, especially in the case of patients who were in good neurological condition on admission. Rosenorn et al.[19] supposed the clinical condition of the patients on admission was an appropriate prognostic factor when comparing the older (60~79) and younger(10~39) age-groups. And the difference in total outcome between the two groups may be explained to a certain extent by a significantly poorer clinical condition in the older patients on admission.

As expected, we found many preoperative and postoperative intracrainal and systemic problems in lots of patients. The correlation between vasospasm and the age of patients with SAH has been investigated with varing results. Macdonald et al.[10] suggested that the incidence of vasospasm was lower in the eldery, whereas Inagawa[5] reported that there was no correlation between the two groups. In the present study, we found that older patients developed less vasospasm (YG:OG = 24.6%:5.2%, $p<0.01$). It may be due to atherosclerosis and increased stiffness of the arterial wall. Comparing with treatment outcome in the two groups, because vasospasm was less frequent in old patient, several additional factors contributing to neurological worsening can be suggested. We found preoperative problems including IVH, hydrocephaus, rebleeding, postoperative intracranial complications such as hydrocephalus, subdural fluid collection, and systemic complications such as hyponatremia, pnemonia, cardiac

decompensation. They would contribute to neurological deteriolation and these conditions were also observed more frequently in the OG. Therefore, meticulous attention should be paid not only to neurological and radiological fi-ndings, but also to systemic conditions.

Conclusion

There were significant differences in the locations of aneurysms, sex distribution between the YG and the OG. Among patients in the YG, the aneurysms were located more often on the A-com. In contrast to the definitive female predominance of intracranial aneurysms found in the 8th, 9th decades, a male predominance was seen in the 3rd, 4th decades. The overall poor outcome in the OG is explained by factors such as poor clinical condition at admission, larger amount of blood on the CT scan, and perioperative complications such as hydrocephalus, IVH, higher rebleeding rates and systemic medical problems.

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