Stroke

RESEARCH LETTER

Differences Between Subarachnoid Hemorrhage Seen in Daily Practice and Aneurysms That Rupture During Follow-Up

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To prevent subarachnoid hemorrhage (SAH), unruptured intracranial aneurysms with assumed high rupture risks are usually repaired based on the results of prospective cohort studies.[1,2] A dilemma exist as SAH is sometimes caused by small aneurysms, which are thought to be safe without repair in follow-up cohorts.[3] A hypothesis to explain this difference is that most SAH-related aneurysms rupture immediately after formation and detection is difficult with routine imaging.[4] By comparing these 2 groups, we aimed to elucidate potential risk factors for the acute onset of SAH, the formation of aneurysms, and their abrupt rupture.

This study was approved by the Research Ethics Committee of the Japanese Neurosurgical Society. The data that support the findings of this study are available from the corresponding author upon reasonable request. Two hundred fifty-six consecutive patients with saccular ruptured aneurysms and acute SAH with no previous follow-up comprised the SAH group (Group 1). Group 2 comprised 111 patients with aneurysms that ruptured during follow-up in the UCAS Japan study (Unruptured Cerebral Aneurysm Study Japan).[2] Baseline patient characteristics, history, and radiographic findings of the groups were compared. Detailed clinical materials and methods are described in the Data Supplement.

Patients within the population considered were all Japanese. The baseline characteristics and results of univariate and multivariate analysis were shown in the Table. Multivariate logistic regression analysis showed that female sex (adjusted odds ratio [aOR], 2.65 [95% CI, 1.16–6.06]); aneurysm diameter per 1-mm increment (aOR, 0.89 [95% CI, 0.85–0.94]); multiple aneurysms (aOR, 3.42 [95% CI, 1.70–6.90]); hyperlipidemia (aOR, 13.3 [95% CI, 5.52–32.15]); and smoking history (aOR, 16.75, [95% CI, 6.92–40.55]) were significantly associated with Group 1.

Aneurysms in patients with SAH seen in daily clinical practice tended to be small with female predominance, more frequently displayed a multiple aneurysm comorbidity, and were more likely to have a smoking history and hyperlipidemia.

The present study highlighted many differences between patients with aneurysm-related SAH (Group 1) and those whose aneurysm ruptured during follow-up (Group 2), especially in the aspect of the presence of vascular comorbidities. Small aneurysms tend to form more frequently and rupture when lifestyle-related diseases and smoking are involved. These findings emphasize the importance of public health. Reducing risk factors such as smoking cessation and controlling hyperlipidemia, especially for women, is important for minimizing the occurrence of SAH. In addition, while the present study did not show that controlling risk factors reduces the rupture rate of unruptured intracranial aneurysms, optimal medical treatment might be important throughout the follow-up of patients with unruptured intracranial aneurysms.

The limitations of present study include that a prospective multicenter cohort and retrospective single-center

Key Words: aneurysm, ruptured ■ intracranial aneurysm ■ multivariate analysis ■ risk factors ■ subarachnoid hemorrhage

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Nonstandard Abbreviations and Acronyms

aOR	adjusted odds ratio
SAH	subarachnoid hemorrhage

cohort were compared. Therefore, follow-up group may have been more frequently treated and educated about comorbidities during observation. In addition, aneurysms more likely to rupture in UCAS Japan were treated and would have been excluded. As a result, follow-up group inherently consists of patients thought to be at a low risk of rupture and this creates a selection bias. Also, since the Group 1 comprises cases from one institution, the characteristics of aneurysms might be influenced by the referral bias. However, it is generally known that small aneurysm tend to be more ruptured in the daily clinical scene. Therefore, the comparison between small aneurysms (SAH related-group) and larger aneurysms (follow-up group) should be match the aim of this study.

This study aimed to reveal the characteristics of ruptured aneurysms immediately after formation but was limited because of the uncertainty about the timing of aneurysm formation. Aneurysms in Group 1 might include those that grew slowly after formation and were undetected before rupture. Hence, individuals in our study were not compared solely based on differences between aneurysms that ruptured immediately after formation and those that were stable for an extended period and then ruptured. Nevertheless, since majority of aneurysms in Group 1 are small, they should at least partially represent acutely formed aneurysms.

ARTICLE INFORMATION

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Supplemental Materials

Expanded Materials and Methods
Expanded study limitations
Online Tables I and II
Online Figure I

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Table. Baseline Characteristics and Multivariate Analysis of the Study

Characteristics	Aneurysms in the SAH group (group 1) (N=256)	Follow and ruptured aneurysm group (group 2) (N=111)	Univariate analysis	Multivariate analysis		
			P value	Adjusted odds ratio	CI (95%)	*P* value
Age (mean, SD)	61.4±14.2	68.5±10.4	<0.001*	0.98	0.96–1.01	0.208
Female sex	192 (75.0)	83 (74.8)	0.964	2.65	1.16–6.06	0.021*
Family history of SAH, no. (%)	38 (14.8)	10 (9.0)	0.128	0.82	0.31–2.18	0.688
Former or current smoking	146 (57.0)	12 (10.8)	<0.001*	16.75	6.92–40.56	<0.001*
Size (mean, SD)	6.74±4.32	10.92±8.83	<0.001*	0.89	0.85–0.94	<0.001*
Medical history, no. (%)						
Multiple aneurysms	93 (38.3)	25 (22.5)	0.003*	3.42	1.70–6.90	0.003*
Hypertension	143 (55.9)	64 (57.7)	0.750	0.57	0.30–1.08	0.085
Hyperlipidemia	108 (42.2)	11 (9.9)	<0.001*	13.32	5.52–32.15	<0.001*
Diabetes	16 (6.3)	6 (5.4)	0.754	0.72	0.20–2.57	0.613
Polycystic kidney disease	2 (0.8)	0	0.350	NA	NA	NA
Location of aneurysm, no. (%)						
MCA	58 (22.7)	26 (23.4)	Ref			Ref
IC-Pcom	66 (25.8)	32 (28.8)	0.806	0.93	0.40–2.18	0.871
Other ICA†	17 (6.6)	7 (6.3)	0.867	0.34	0.09–1.26	0.106
Acom	82 (32.0)	23 (20.4)	0.160	1.55	0.66–3.65	0.312
Distal ACA	14 (5.5)	1 (0.9)	0.084	5.08	0.46–55.7	0.183
VA	7 (2.7)	2 (1.8)	0.590	2.79	0.34–23.16	0.343
BA‡	8 (3.1)	15 (13.5)	0.004*	0.29	0.07–1.19	0.086
Others	4 (1.6)	5 (4.5)	0.149	0.27	0.05–1.66	0.159

ACA indicates anterior cerebral artery; Acom, anterior communicating artery; BA, basilar artery; ICA, internal carotid artery; IC-Pcom, internal carotid to posterior communicating artery; MCA, middle cerebral artery; NA, not applicable; SAH, subarachnoid hemorrhage; and VA, vertebral artery.

*Statistical significance.

†Other ICA includes IC-duplicated MCA, IC-anterior choroidal, IC-bifurcation, and IC-paraclinoid aneurysms.

‡BA includes BA bifurcation and BA-superior cerebellar artery aneurysms.