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The Incidence of Aneurysmal Subarachnoid Hemorrhage in Youngdong District, Korea

Objective : The purpose of this study is to investigate the incidence of aneurysmal subarachnoid hemorrhage (SAH) in Youngdong district for 10 years.

Methods : From Jan. 1997 to Dec. 2006, 732 patients (327 males, 405 females, mean age: 54.8 ± 13.1 years) with spontaneous SAH were admitted to our hospital. We reviewed the medical records and radiological findings regarding to the ictus of SAH, location and size of the ruptured aneurysms, Hunt-Hess grade and Fisher grade on admission, personal details such as address, age, and sex, and previous history of medical diseases.

Results : In these 732 patients, 672 cases were confirmed as aneurysmal SAH. Among them, 611 patients (262 males, 349 females, mean age: 54.9 ± 13.2 years) came from Youngdong district. The average crude annual incidence of aneurysmal SAH for men, women, and both sexes combined in Youngdong district was 7.8 ± 1.7 , 10.5 ± 2.7 , and 9.1 ± 2.1 per 100,000 population, respectively. Because of the problems related to the observation period and geographical confinement, it was suspected that the representative incidence of aneurysmal SAH in Youngdong district should be made during the later eight years in six coastal regions. Therefore, the average age-adjusted annual incidence for men, women, and both sexes combined was 8.8 ± 1.4 , 11.2 ± 1.3 and 10.0 ± 1.0 , respectively in the coastal regions of Youngdong district from 1999 to 2006.

Conclusion : In overall, our results on the incidence of aneurysmal SAH was not very different from previous observations from other studies.

KEY WORDS : Aneurysmal SAH · Epidemiology · Incidence.

INTRODUCTION

Although numerous patients suffer and die from aneurysmal subarachnoid hemorrhage (SAH), its incidence has been rarely reported in Korea until recently. The incidence of aneurysmal SAH has ranged widely among reports from different regions of the world and at different points in time^{3,5-7,9-12,14,18,20,25}. Since the era of the computed tomography, the lower incidences were reported in England, France, and USA ranging from 2 to 10 annual incidences per 100,000 populations^{3,6,11}. However, higher results exceeding 20 annual incidence per 100,000 populations were reported in some published studies from Japan and Finland^{9,10,12,14,18,20,25}. The estimated incidence can be influenced by the age and size of population studied, difference on diagnostic accuracy, criteria adopted to define the aneurysmal SAH, type of study, and methodology for collecting data. The ideal study for evaluation of accurate incidence of the aneurysmal SAH can be executed when the subject area is isolated and has well-established patient-referring system^{17,22,23}. Because most institutions treating aneurysmal SAH covers overlapped area and a number of the patients of aneurysmal SAH in same geographic area have been treated in various hospitals, it is very difficult to obtain the accurate incidence of aneurysmal SAH in Korea.

Youngdong district is located in the middle-eastern part of Korean peninsula, and is composed of 5 cities and 4 counties (Fig. 1). It covers an area of 6791.95 km², and its population approximates 0.65 million according to mean Korean census population of 2000 and 2005. It has temperate and moist oceanic climate. There are no large industries, and most residents are engaging in tourist-associated business, agriculture, or fishery, therefore the social and the demographic composition is relatively stable in this district. However, it is geographically isolated area; separating from North Korea by Military Demarcation Line, and facing the East Sea on its eastern coast. Taebaek Mountain range lies west of Youngdong district and interrupts it from

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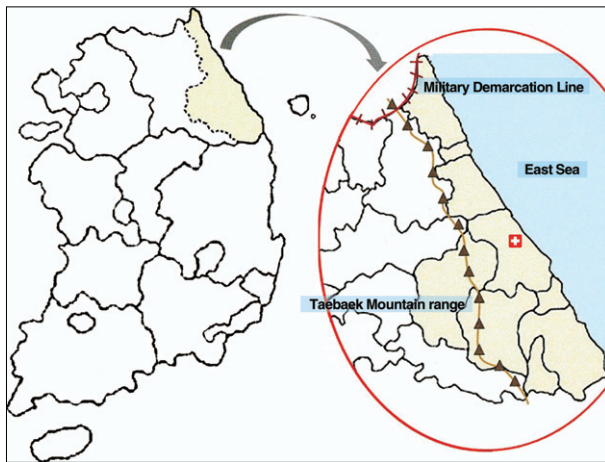


Fig. 1. Geographical isolation of Youngdong district. Youngdong district is separated from North Korea by Military Demarcation Line, and faces the East Sea on its eastern coast. Taebaek Mountain range lies west of Youngdong district and interrupts it from Youngseo district. To the south of Youngdong district, even though only a small river lies between Youngdong district and Gyeongsangbuk-do, the patients from even most southern area of Youngdong district must make efforts to access the nearest hospital of Gyeongsangbuk-do taking more than 3 hours using narrow national road, while it takes 1.5 hours to the Gangneung Asan Hospital (hospital symbol).

Youngseo district. To the south of Youngdong district, even though only a small river lies between Youngdong district and Gyeongsangbuk-do, the patients from even Samcheok si, the most southern area of Youngdong district, must make efforts to access the nearest hospital of Gyeongsangbuk-do taking more than 3 hours using narrow national road, while it takes 1.5 hours to the Gangneung Asan Hospital. This institute is the only hospital with neurosurgical department capable of surgical treatment of aneurysmal SAH as shown at Fig. 1. With designated emergency center and capability of surgical treatment for aneurysmal SAH, almost all patients with verified or suspected SAH, even if moribund, are immediately referred to our hospital, irrespective of age or clinical condition. Although the emergency referring system in this area has not been well established, there is a low possibility that patients suspected aneurysmal SAH, would be referred to the hospitals in other districts because of these geographic characteristics.

We assumed that the investigation of the incidence of aneurysmal SAH with the results obtained from this area could minimize the selection bias and errors.

MATERIALS AND METHODS

From Jan. 1997 to Dec. 2006, 732 patients (327 males, 405 females, mean age : 54.8 ± 13.1 years) with spontaneous SAH were admitted to our hospital. The patients with spontaneous SAH caused by other diseases such as cerebral arteriovenous malformation and tumor were excluded in this study. Among

those 732 patients, 697 patients were verified SAH on CT scanning. Lumbar puncture was used to verification of SAH in the other 35 patients because of the CT findings were ambiguous though they were highly suspected. When SAH was verified on CT scanning or lumbar puncture, digital subtraction cerebral angiography or three-dimensional CT angiography was performed. In these 732 patients, 701 patients underwent angiographic evaluation, but the other 31 did not because of poor clinical condition or refusal from family members. Six-hundred-seventy-two cases were confirmed as aneurysmal SAH, and the other 29 were diagnosed as so-called perimesencephalic SAH. These 29 cases were also excluded in this investigation.

We reviewed the medical records and radiological findings about the informations on the ictus of SAH, location and size of the ruptured aneurysms, Hunt-Hess grade, Fisher grade, and Glasgow Coma Scale (GCS) on admission, personal details such as address, age, and sex, and previous history of medical diseases. We confined the patient population as residents in Youngdong district. Because the demographic composition of this area can be different from that of Korea, the age- and sex-adjusted annual incidence was estimated based on the mean Korean census populations of 2000 and 2005 to establish the comparable incidence. Because the Korean census population is investigated every 5 years, we could not but use the mean populations to estimate the crude and adjusted incidences. As a matter of fact, the difference between the Korean census population of 2000 and that of 2005 was not much in size (638,739 in 2000 vs. 659,715 in 2005). Population figures were obtained from the home page of Korean National Statistical Office on line. Finally, the results were compared with the previous studies.

Statistical Analysis

We compared continuous variables by using Student's t-tests and compared categorical variables by using Chi-Square tests. Comparisons were made according to confidence intervals of 95%. All statistical tests were two-sided and all analyses were performed using statistical software (SPSS for Windows, 13.0 standard version). A probability value less than 0.05 was considered statistically significant.

RESULTS

During the 10-year period from 1997 to 2006, 672 patients with aneurysmal SAH were hospitalized. Among them, 611 patients (262 males, 349 females, mean age : 54.9 ± 13.2 years) came from Youngdong district and the other 61 patients came from other district. The average age of patients was 51.5 ± 13.2 for male, and 57.4 ± 12.5 for female. The age

Table 1. The Age and Sex distribution of the patients with aneurysmal subarachnoid hemorrhage from individual city or county in Youngdong district

City or county	Sex	No. of Patient	Mean age
Goseong-gun	Male	21	53.0±12.1
	Female	24	56.3±10.7
Sokcho-si	Male	49	50.7±14.3
	Female	45	53.6±12.9
Yangyang-gun	Male	14	50.6±12.2
	Female	28	60.3±10.2
Gangneung-si	Male	82	52.8±11.7
	Female	127	58.3±12.7
Donghae-si	Male	39	47.0±14.1
	Female	47	57.3±12.0
Samcheok-si	Male	26	51.6±15.0
	Female	43	61.3±12.7
Taebaek-si	Male	18	54.8±13.4
	Female	12	47.6±16.5
Jeongseon-gun	Male	9	52.0±13.0
	Female	6	58.0±14.4
Pyeongchang-gun	Male	4	55.0±19.4
	Female	17	54.4± 8.9
Total	Male	262	51.5±13.2
	Female	349	57.4±12.5

and sex distributions of the patients from individual city and county in Youngdong district are shown in Table 1.

Incidence

From 1997 to 2006, the average crude annual incidence of aneurysmal SAH per 100,000 population in Youngdong district was 7.8 ± 1.7 , 10.5 ± 2.7 and 9.1 ± 2.1 for men, women, and both sexes combined, respectively. The variation of the incidence during this period is shown in Table 2 and Fig. 2. Since the demographic composition of Youngdong district is different from that of Korean standard population (Fig. 3), we calculated the age- and sex-adjusted annual incidence based on Korean population census 2000 and

Table 2. The serial changes of the crude incidence of aneurysmal subarachnoid hemorrhage in Youngdong district from 1997 to 2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Male	4.5*	5.7	9.2	8.9	7.7	7.7	10.1	9.5	7.4	7.1
Female	4.2	8.4	10.9	11.2	9.3	12.7	11.8	12.1	13.3	11.5
Total	4.3	7.0	10.0	10.0	8.5	10.2	10.9	10.8	10.3	9.3

*incidence per 100,000 / year

Table 3. The serial changes of the age- and sex-adjusted annual incidence of aneurysmal subarachnoid hemorrhage in Youngdong district from 1997 to 2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Male	4.3*	5.2	8.5	8.2	7.1	6.9	9.2	8.8	6.6	6.7
Female	3.6*	7.4	9.5	9.5	8.1	10.9	10.5	9.6	11.1	9.2
Total	4.0†	6.3	9.0	8.9	7.6	8.8	9.8	9.2	8.8	8.0

*The age-adjusted annual incidence based on Korean census population, †The age- and sex-adjusted annual incidence based on Korean census population

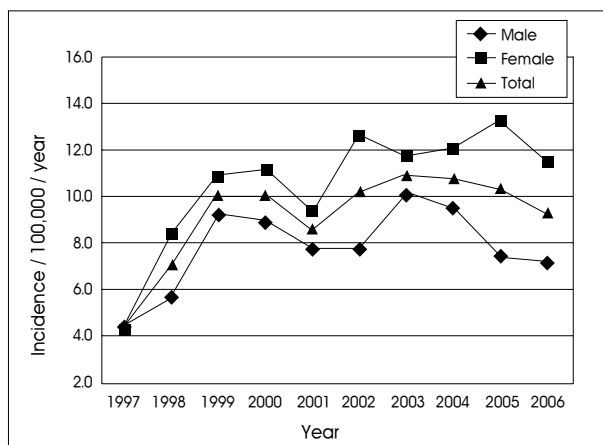


Fig. 2. The Serial changes of crude annual incidence of aneurysmal subarachnoid hemorrhage in Youngdong district from 1997 to 2006.

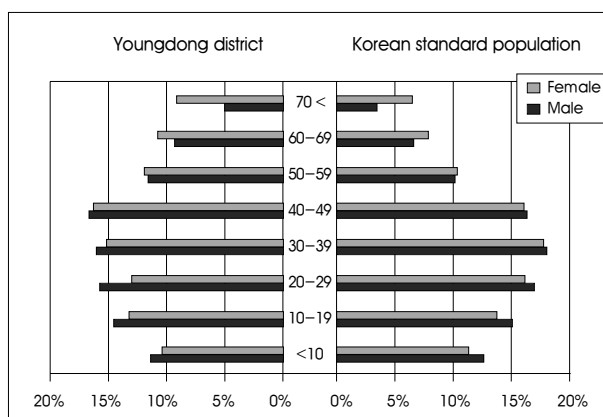


Fig. 3. The Comparison of the demographic composition of Youngdong district with that of Korean standard population. There is a higher proportion of the ageing population in Youngdong district than in Korean standard population.

2005 (Table 3). The average age-adjusted annual incidence from 1997 to 2006 was 7.2 ± 1.6 , 8.9 ± 2.2 , and 8.0 ± 1.7 for men, women, and both sexes combined, respectively. The serial changes of the age- and sex-adjusted annual incidence during this period are shown in Fig. 4. In this graph, there

was an exceptionally lower annual incidences during the setting-up periods of the hospital (from 1997 to 1998) than those after 1998. The comparison study was done between the annual incidences during first 2 years and later 8 years, and it showed statistically significant difference (5.2 ± 1.6 , 8.8 ± 0.7 , $p=0.001$). Therefore, the average age- and sex-adjusted annual incidence of later 8 years was somewhat higher than those of whole ten years (7.8 ± 1.0 , 9.8 ± 1.0 , and 8.8 ± 0.7 for men, women, and both sexes combined, respectively).

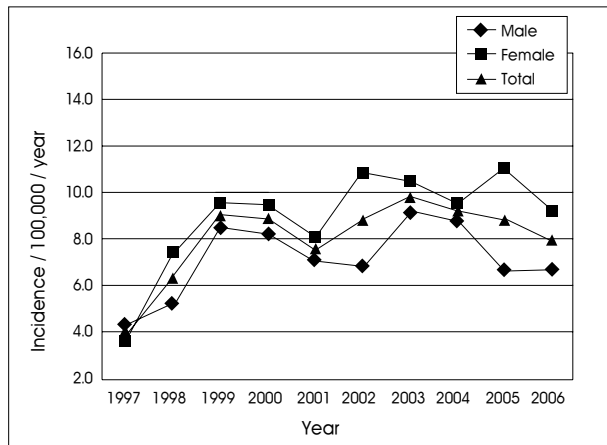


Fig. 4. The Serial changes of the age- and sex-adjusted annual incidence of aneurysmal subarachnoid hemorrhage in Youngdong district from 1997 to 2006. The graph shows exceptionally lower annual incidences during the setting-up period of the hospital (from 1997 to 1998) than those after 1998. The incidences between 1999 and 2006 show annual variations, however, they do not show statistical significance ($p>0.05$).

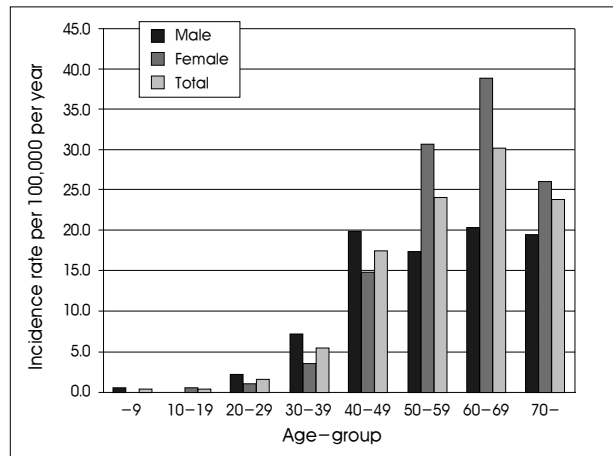


Fig. 6. Comparison of the average annual incidence rates of aneurysmal SAH for male and female according to the age group. The incidence rates are similar or slightly male-predominant until the 5th decade of life. However, the occurrence of aneurysmal SAH reaches a plateau at age 40 and leveled off thereafter in male, on the other hand, it increases almost linearly after age 40 and peaked in their 7th decades in female.

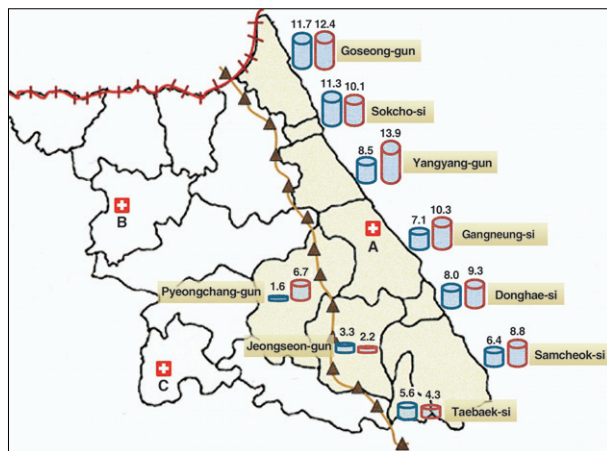


Fig. 5. The regional variation of the average annual incidences. The incidences of the three regions located inland are distinctively lower than those of the other six regions facing the East Sea. A : Gangneung Asan Hospital, B : Chuncheon Hallym Medical Center, C : Wonju Christian Hospital.

Table 4. The average annual incidences of aneurysmal subarachnoid hemorrhage for male and female according to the age group in Youngdong district from 1999 to 2006

Age (yr)	No.	Male		Female		Total	
		No.	Incidence (95% CI)	No.	Incidence (95% CI)	No.	Incidence (95% CI)
-9	1	0	0.4* (0.0-1.2)	0	0.0	1	0.2 (0.0-0.6)
10-19	0	1	0.0	1	0.3 (0.0-1.0)	1	0.2 (0.0-0.5)
20-29	7	3	2.0 (0.6-3.4)	3	1.1 (0.0-2.6)	10	1.6 (0.5-2.7)
30-39	25	12	7.3 (4.6-10.0)	12	3.6 (2.0-5.2)	37	5.5 (4.2-6.8)
40-49	69	51	19.9 (17.3-22.5)	51	14.8 (8.6-21.0)	120	17.4 (14.4-20.4)
50-59	41	75	17.3 (15.0-19.6)	75	30.8 (21.1-40.5)	116	24.1 (18.8-29.4)
60-69	38	84	20.4 (17.3-23.5)	84	38.9 (30.6-47.2)	122	30.3 (25.3-35.3)
70-	20	50	19.5 (13.0-26.0)	50	26.1 (18.1-34.1)	70	23.8 (18.4-29.2)
Total	201	276	8.8† (7.8-9.8)	276	11.2† (10.3-12.1)	477	10.0‡ (9.3-10.7)

*The average crude annual incidence per 100,000 / year, †The average age-adjusted annual incidence based on Korean census population, ‡The average age- and sex-adjusted annual incidence based on Korean census population

The regional variation of the average annual incidences was shown at Fig. 5. The incidences of the three regions located inland were distinctively lower than those of the other six regions facing the East Sea (Fig. 5). The comparison study was done between the average annual incidences between these two groups, and it also showed significant difference statistically ($4.0 \pm 1.1, 9.9 \pm 1.8, p=0.001$).

Therefore, it was decided that the representative incidence of aneurysmal SAH in Youngdong district should be made during the later eight years in six coastal regions. From 1999 to 2006, the average age-adjusted annual incidence of aneurysmal SAH per 100,000 population were $8.8 \pm 1.4, 11.2 \pm 1.3,$ and 10.0 ± 1.0 for men, women, and both sexes combined, respectively, in coastal regions of Youngdong district (Table 4).

According to our data, the average annual incidence rates of aneurysmal SAH for male and female were similar or slightly male-predominant until the 5th decade of life. However, the occurrence of aneurysmal SAH reached a plateau at age 40 and leveled off thereafter in male. On the other hand, it increased almost linearly after age 40 and peaked in 7th decade in female (Fig. 6).

Clinical and radiological findings

The locations of aneurysms are shown in table 5 and Fig. 7. The most common location of ruptured aneurysm was anterior communicating artery in both sexes (Table 5, Fig. 7). However, the posterior communicating artery aneurysms were

Table 5. Locations of ruptured intracranial aneurysms in Youngdong district

Locations	Male	Female	Total	p value
A1 & AComA*	106 (40.5%)	113 (32.4%)	219 (35.8%)	0.041
Distal ACA	10 (3.8%)	8 (2.3%)	18 (3.0%)	0.000
PCoMA	39 (14.9%)	94 (26.9%)	133 (21.8%)	0.027
ICA except PCoMA	20 (7.6%)	12 (3.4%)	32 (5.2%)	1.000
MCA	76 (29.0%)	101 (28.9%)	177 (29.0%)	0.362
Post. Circulation	11 (4.2%)	21 (6.0%)	32 (5.2%)	0.335
Total	262	349	611	

*A1&AComA : A1 segment of anterior cerebral artery and anterior communicating artery, Distal ACA : anterior cerebral artery distal to anterior communicating artery, PCoMA : posterior communicating artery, ICA : internal cerebral artery, MCA : middle cerebral artery, Post. Circulation : vertebrasilar artery and posterior cerebral artery

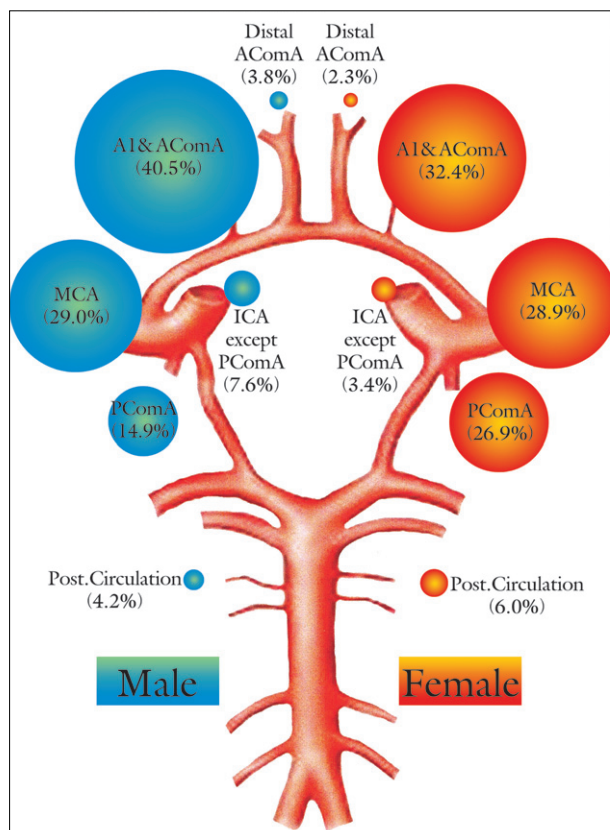


Fig. 7. The distributions of the locations of ruptured aneurysms according to sex. The most common location of ruptured aneurysm is anterior communicating artery in both sexes. However, posterior communicating artery aneurysms are more frequent in female, and on the contrary, anterior communicating artery aneurysms are more frequent in male.

more frequent in female (14.9%, 26.9%, $p=0.027$), and on the contrary, A1 segment of anterior cerebral artery and anterior communicating artery aneurysms were more frequent in male (40.5%, 32.4%, $p=0.041$). Among 611 patients, 80 patients had multiple aneurysms. The multiplicity of the aneurysm was more frequently found in female patients than in male (55 in 349 female, 25 in 262 male, $p=0.029$).

The neurological status and CT findings were classified according to the Hunt-Hess grading system and Fisher

grading system (Table 6). There were no significant differences between both sexes in Hunt-Hess grade and Fisher grade.

DISCUSSION

With regards to the study on the incidence of aneurysmal SAH, there are several difficulties because of following points. In community-based studies, if study covers a large geographic region, a number of SAH patients, especially those in the outlying areas, may never reach the hospital and die before receiving medical care or may be treated at hospital of other district^{14,24}. On the contrary, if populations are too small, it is difficult to assess accurate incidence rates^{14,17,23}. In hospital-based studies, the patients could be missed if they were dead on arrival or transferred to other hospital. Therefore, the referring systems for SAH patients must be well established in hospital-based studies^{14,17,23}. Current study, a hospital-based study, covers a large geographic area of 6791.95 km² and populations that run into about 0.65 million. Although the referring systems in this district had not been well established, it is speculated that the geographical isolation could minimize the number of the missed patients who reside especially in the outlying areas.

However, as shown at the Fig. 4, annual incidences during the setting-up periods of the hospital were exceptionally low. Because the referring system was under construction, the annual incidences during that period might not be helpful to predict the real incidence. In addition, we think that topographical and traffic factors could make influence on the results in the three regions located inland; Pyeongchang-gun, Jeongseon-gun, and Taebaek-si. The former two counties are partly belonged to Youngdong district and also partly to Youngseo district (traversed by Taebaek mountain range). The patients from these regions accordingly could be referred to the other hospital such as Chuncheon Hallym Medical Center or Wonju Christian Hospital at Fig. 5. There is no significant difference in the distance from the latter Taebaek-si to our hospital or to Wonju Christian Hospital. Therefore, it might be explained why the incidences of these three regions were lower than those of the other six regions (Fig. 5). For these reasons above mentioned, it is reasonable that the representative incidence of aneurysmal SAH in Youngdong district should be made during the later eight years in six coastal regions.

Besides, there were a few patients who were excluded in this investigation because of the lack of angiographical diagnosis even though they presented with definite SAH. It might bring

Table 6. Initial neurological and radiological grade

Grading system		Male (%)	Female (%)	Total (%)
Hunt–Hess grade	1	17 (6.5)	24 (6.9)	41 (6.7)
	2	118 (45.0)	142 (40.7)	260 (42.6)
	3	82 (31.3)	107 (30.7)	189 (30.9)
	4	39 (14.9)	70 (20.1)	109 (17.8)
	5	6 (2.3)	6 (1.7)	12 (2.0)
Fisher grade	1	14 (5.3)	14 (4.0)	28 (4.6)
	2	56 (21.4)	64 (18.3)	120 (19.6)
	3	122 (46.6)	184 (52.7)	306 (50.1)
	4	70 (26.7)	87 (24.9)	157 (25.7)
Total		262	349	611

Table 7. Average annual incidences of spontaneous subarachnoid hemorrhage

Study	Period (years)	Size of population	Age years	Annual incidence	SAH
Greater Cincinnati, Ohio, America ⁽⁴⁾	1988	1,258,180	All ages	6	Aneurysmal
Melbourne, Australia ⁽⁵⁾	1978–1979	160,000	≥ 35	26.4	Primary*
Oxfordshire, England ⁽²⁾	1981–1986	105,000	All ages	8	Primary
Central Finland ^(7,8)	1976–1978	246,000	All ages	20	Primary
	1980–1987	24,600	All ages	16	Primary
Three areas, Finland ⁽⁶⁾	1983–1985	385,011	25–74	30	Primary
Dijon, France ⁽⁹⁾	1985–1989	140,000	All ages	2	Primary
Yamaguchi, Japan ⁽²⁰⁾	1985–1995	1,500,000	All ages	14 [†]	Aneurysmal
Izumo, Japan ⁽²⁾	1987–1992	82,697	All ages	23 [†]	Aneurysmal
Auckland, New Zealand ⁽³⁾	1981, 1983	829,454	≥ 15	14	Primary
Youngdong district, Korea (Current study)	1999–2006	515,843 [‡]	All ages	10.0 [†]	Aneurysmal

*SAH caused by not only aneurysm but also arteriovenous malformation, tumor, etc., †The age- and sex-adjusted annual incidences, ‡Population of Youngdong district except three inland regions

down the result from the actual incidence.

On the other hand, because there was a higher proportion of the elderly population in Youngdong district than in Korean standard population (Fig. 3), the crude annual incidence was higher than the age- and sex-adjusted annual incidence based on Korean population census (Table 2, 3, Fig. 2, 4).

Meanwhile, although the incidence of angiogram-negative subarachnoid hemorrhage has been accepted as to be approximately 15%, current study showed the less than this^(2,4,21). However, much lower incidences have been reported recently as improvement of diagnostic imaging capability^(15,16).

As for the incidence of aneurysmal SAH in Korea, we had speculated its resemblance to the Japanese before current study because of racial and geographical similarities. To our knowledge, however, there had been no reports on the geographical incidence of aneurysmal SAH in Korea, so we compared our results with the results from other parts of the world including Japan (Table 7). According to the previous studies, the annual incidences of spontaneous SAH varied from 2 to 23/100,000/yr in all age group^(3,5,7-12,14,18,20,25). The incidences of SAH in Finland and Japan are among the highest in the world, otherwise lower incidences of SAH have

been reported from England, France, and USA. Comparison between studies is hampered by the lack of agreed-upon criteria for the classification of SAH and by the different age structures of the populations studied. In our study, the average age-adjusted annual incidence for men and women was 8.8, 11.2, and age- and sex-adjusted average annual incidence was 10.0 in the coastal regions of Youngdong district by means of the mean census population of Korea in 2000 and 2005. The result of current study shows relative lower incidence rate than the results of other countries such as Finland or Japan. Although this result could reflect the actual incidence of Youngdong district, there might have been some missed cases from several possible reasons such as incomplete referring system and lack of angiographic confirmation or autopsy. Autopsy or other further evaluation is not a routine performance in cases of already dead on arrival due to the cultural pattern of Korea, and still, many people of Korea especially in rural district prefer to close their day at home naturally and their

family tends to hold a funeral without any evaluation for cause of death. Therefore, we agree that the actual incidence of aneurysmal SAH in our subject area is undoubtedly higher than the current study.

According to the age group, there was different pattern about the annual incidence rates of aneurysmal SAH for male and female. In male, the occurrence of aneurysmal SAH reached a plateau at age 40 and leveled off thereafter. In female, however, it increased almost linearly after age 40 and peaked in their 7th decades. Previous studies have already documented that the incidence rate of aneurysmal SAH increases in women after age of 50 or 60^(1,10,12). Although the reason for this increase in postmenopausal women is unclear, there are many reports that hormonal factor, especially decreased estrogen level, might play a role in aneurysmal formation and rupture. In addition, the role of environmental and/or genetic factors needs further investigation to reveal underlying pathophysiology that may account for the observed sexual difference^(1,10,12).

As for the distribution of the aneurysmal locations and clinical and radiological grade at admission, there were compatible findings with those previous reports for the most part^(13,19).

CONCLUSION

In general, our results on incidence of aneurysmal SAH was not different from previous observations of other foreign studies. However, the epidemiologic study on aneurysmal SAH in various regions has not been previously reported in Korea, therefore further studies should be conducted in comparison with other regions in Korea.

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COMMENTARY

The aim of this study was to report the incidence of aneurysmal subarachnoid hemorrhage (SAH) in Youngdong district, Korea. To date, there is no nation wide epidemiologic study on aneurysmal SAH, so that this paper would be much helpful to investigate further and more accurate study of the incidence of SAH in our nation.

The geographically isolated Youngdong district had the better point to evaluate clinical analyses of patients, but difficult transportation system and higher rate of old population rather than other part of Korea might be made somewhat more larger statistical bias.

It is well known that Japan and Finland are the highest incidence of aneurysmal SAH. The incidence of our nation should be more likely of that of Japan in every point of view, even this study showed much lower rate. The economic status, referring system to hospital and the old tradition of Korean such as the evading autopsy to find out exact cause of death etc, we thought, had influenced the lower incidence of author's assessment. The sharply increased the rate of incidence of this literature from 4.3% in 1997 to 10.0% in 2000 in this district would be a good instance. The one of the interesting points of this paper was the peak age incidence of female was 7th decade, this is rather different from other previous studies.

We congratulate the authors on the success of difficult statistical analyses which would be valuable to further larger aneurysmal study.

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