

## Clinical Article

# Incidence rate of Aneurysmal SAH in Gwangju City and Jeollanamdo Province in 2007

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**Objective** : The incidence of subarachnoid hemorrhage (SAH) worldwide varies considerably. In spite of many reports about the incidence of SAH, there has been no report about the incidence of SAH on the basis of the Korean population. The purpose of this hospital-based study was to assess the actual incidence rates of aneurysmal SAH in Gwangju city and Jeollanamdo province.

**Methods** : All cases of SAH confirmed by computerized tomography (CT) between January 2007 and December 2007 were selected for analysis. For the data collection, three major training hospital and ten general hospitals working the CT in Gwangju city and four major general hospitals in Jeollanamdo province participate in this study.

**Results** : According to the official census of Korea, the population was 1,413,444 in Gwangju city and 1,929,836 in Jeollanamdo province in 2007. There were 163 patients in Gwangju city and 266 patients in Jeollanamdo province confirmed SAH by CT in 2007. The crude and the age- and sex-adjusted annual incidence rates per 100,000 population for all ages in Gwangju city were 11.5 and 12.4 for aneurysmal SAH and in Jeollanamdo province were 13.8 and 10.8. The incidence was higher in women and increased with age. The gender distribution varied with age. At young ages, the incidence was higher in men while after the age of 40 years, the incidence was higher in women.

**Conclusion** : In the present study, the age- and sex-adjusted annual incidence rates is 11.8 in Gwangju city and Jeollanamdo province. The incidence was higher in women and increased with age.

**KEY WORDS** : Subarachnoid hemorrhage · Incidence rate · Risk factor · Gwangju · Jeollanamdo.

## INTRODUCTION

There have been many studies on the incidence of aneurysmal subarachnoid hemorrhage (SAH) with widely varying annual incidences<sup>2,3,6,8-12</sup>. The overall incidence of SAH was approximately 10 to 11 cases per 100,000 persons per year but varies significantly by region, with doubled rates in Japan and Finland and far lower rates in South and Central America<sup>3,8-11</sup>. The reported incidence of SAH depends on the various factors : the nature of population<sup>8,10</sup>, the quality of diagnostic techniques, the size of the population, the diagnostic criteria, the age distribution of

the population, the sophistication of data collection and analysis and factors that may increase the likelihood of occurrence of the disease<sup>3,14</sup>. In spite of many reports about the incidence of SAH, there has been no report about the incidence of SAH on the basis of the Korean population.

Authors estimated the incidence rate of aneurysmal SAH in Gwangju City and Jeollanamdo province confirming the diagnosis by computerized tomography (CT) scanning of the brain or surgery.

## MATERIALS AND METHODS

Data have been collected retrospectively on first-ever strokes in patients of all age groups in Gwangju city and Jeollanamdo province. For this data collection, three major training hospitals and ten general hospitals in Gwangju city and four major general hospitals in Jeollanamdo province were participated in this study. This study included resi-

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dents of these areas who suffered aneurysmal SAH confirmed by CT scanning or intraoperative finding in 2007 beginning January 1, 2007 and ending December 31, 2007 and patients whose hemorrhages were caused by head trauma, several vascular malformations such as arteriovenous malformation and cavernous malformations, severe bleeding tendency and coagulation disorders were excluded. Besides patients who were admitted or referred to the aforementioned hospitals while alive, we also analyzed those who were dead on arrival. Age and sex-adjusted annual incidence rates were estimated using data from the 2007 Korean population census.

## RESULTS

There were 163 patients in Gwangju city and 266 patients in Jeollanamdo province with aneurysmal SAH. With the respect to the diagnosis, it was verified using CT scanning in all patients. According to the national census of Republic of Korea in 2007, the population of Gwangju city was 1,413,444 and Jeollanamdo province was 1,929,836 (Table 1). In the proportion of old age, Jeollanamdo province was higher than Gwangju city and the proportion of women was increased. Especially above 70 years of age, the number of women was nearly twice of the number of men. The age and sex distribution of the patients is shown in Table 2. The age-specific annual incidence rates are shown in Table 3. The crude annual incidence of aneurysmal SAH in male, female and both sexes combined were 9.8, 13.2, and 11.5 in Gwangju city and 7.7, 19.9, and 13.8 in Jeollanamdo province. There were different incidence rates between women and men. In women patients, the incidence rates increased with advancing age, on the other hand in men patients, the highest incidence rate was found in his middle age. The incidence rates of Jeollanamdo province were higher than those of Gwangju city because the proportion

**Table 1.** Population distribution in Gwangju city and Jeollanamdo province

	Age (years)					Total
	< 40	40-49	50-59	60-69	≥ 70	
Gwangju						
Male	442,954 (31.3)	117,351 (8.3)	72,341 (5.1)	44,945 (3.1)	23,970 (1.6)	701,561 (49.6)
Female	423,104 (29.9)	118,323 (8.4)	75,640 (5.3)	50,777 (3.6)	44,039 (3.1)	711,833 (50.4)
Total	866,058 (61.2)	235,674 (16.7)	147,981 (10.4)	95,722 (6.7)	68,009 (4.7)	1,413,444 (100)
Jeollanamdo						
Male	509,427 (26.3)	160,056 (8.2)	120,563 (6.2)	99,564 (5.1)	73,801 (3.8)	963,411 (49.9)
Female	449,924 (23.3)	140,927 (7.3)	116,133 (6.0)	122,805 (6.4)	136,636 (7.0)	966,425 (50.1)
Total	959,351 (49.6)	300,983 (15.5)	236,696 (12.2)	222,369 (11.5)	210,437 (10.8)	1,929,836 (100)

**Table 2.** Age and sex distribution in patients with aneurysmal SAH per 100,000 population in 2007

	Age (years)					Total
	< 40	40-49	50-59	60-69	≥ 70	
Gwangju						
Male	21	27	10	8	3	69
Female	11	33	12	21	17	94
Total	32	60	22	29	20	163
Jeollanamdo						
Male	5	9	32	23	5	74
Female	3	13	50	60	66	192
Total	8	22	82	83	71	266

SAH : subarachnoid hemorrhage

**Table 3.** Age-specific annual incidence rates of aneurysmal SAH per 100,000 population in 2007

	Age (years)					Total
	< 40	40-49	50-59	60-69	≥ 70	
Gwangju						
Male	4.7	23.0	13.8	17.8	12.5	9.8
Female	2.6	27.9	15.9	41.4	38.6	13.2
Total	3.7	25.5	14.9	30.3	29.4	11.5
Jeollanamdo						
Male	1.0	5.6	26.5	23.1	6.8	7.7
Female	0.7	9.2	43.1	48.9	48.3	19.9
Total	0.8	7.3	34.6	37.3	33.7	13.8

In male patients, the highest incidence rate was found in forties in Gwangju city and fifties in Jeollanamdo province. In female patients, the incidence rate increased with advancing age. SAH : subarachnoid hemorrhage

of old women was higher. However, according to the age and sex-adjusted annual incidence rates, to the contrary, the incidence rates of Gwangju city were higher than those of Jeollanamdo province (Table 4). The incidence rates of male patients in Gwangju city were higher than those in Jeollanamdo province and those of female patients in both areas were nearly same. Synthetically, higher incidence rates of male patients in Gwangju city make this difference of

**Table 4.** Comparison of crude average annual incidence rate with adjusted average annual incidence rate of aneurysmal SAH per 100,000 in 2007

	Crude			Adjusted		
	Male	Female	Total	Male	Female	Total
Gwangju	9.8	13.2	11.5	10.3	14.5	12.4
Jeollanamdo	7.7	19.9	13.8	6.7	14.8	10.8
Both	8.6	17.0	12.8	8.4	15.2	11.8

SAH : subarachnoid hemorrhage

incidence rates of these regions.

**Limitation of this study**

For the incidence rate, there is a possibility that we missed patients who had not been diagnosed correctly because of death before receiving medical service and without autopsy examination or had not admitted other hospitals did not participate this study. Other limitation is short selection period for one year. A period of several years is often necessary to accumulate an adequate number of cases and overcome random variability between years. In the literature review about the epidemiologic study of SAH, most of literatures select the data for over 3 years. And wide area of case ascertainment may lead to error and underestimation of rates caused by problems of registering cases who have received medical attention in outlying areas or who die outside of the study area.

**DISCUSSION**

SAH from a ruptured aneurysm accounts for approximately 5% of all strokes. Because it has a high case mortality and morbidity, it is important to know exact incidence rate and risk factors.

The overall incidence of SAH was 10 to 11 cases per 100,000 persons per year but varied significantly by region, with doubled rates in Japan and Finland and far lower rates in South and Central America. However, to date there has been no report about the incidence of SAH on the basis of the Korean population. In our hospital-based study, conducted in 2007, the crude and the age- and sex-adjusted annual incidence rates per 100,000 population for all ages in Gwangju city were 11.5 and 12.4 for aneurysmal SAH and in Jeollanamdo province were 13.8 and 10.8. The difference of the crude and adjusted annual incidence rates was originated from the age and gender distribution of two areas. Before data analysis, we thought the incidence rate in Jeollanamdo province was higher than the rate in Gwangju city because of older age and female preponderance in Jeollanamdo province. However, contrary to our expectations, the age- and sex-adjusted annual incidence rates in Gwangju city was higher than in Jeollanamdo province. We

think that this unexpected result was caused by the urban life style exposed to the risk factors especially in men.

The incidence was higher in women and increased with age. The gender distribution varied with age. At young ages, incidence was higher in men while after the age of 40 years, the

incidence was higher in women. In Japan study, the incidence plateaued between 45 and 84 years in men and it increased after 45 years and reached the peak in > 75 years<sup>11)</sup>. In Australia and New Zealand study, age-specific rates tend to be bimodal in distribution for males, whereas among females, the trend of increasing rates with age appears attenuated after the menopause (≥ 55 years)<sup>4)</sup>. In the review article, switching of incidence rate between the two gender was 55 years<sup>3)</sup>.

The incidence rate in our study was far lower than in Japan. Before data analysis, we expected the similar rates, but the incidence rate in Japan was 22.7 (95% CI 21.9 to 23.5)<sup>3)</sup>. Why the incidence rates of two similar geographic countries are different? Several factors may contribute to the higher incidence in Japan, but the extent of their contributions remains speculative. Genetic factors may play an important role and the relatively older age in Japan may be another explanation. However, genetic factors explain only 10% of SAH, and most cases are attributed to smoking, hypertension and excessive use of alcohol<sup>13)</sup>. Perhaps the reduction in risk factors is more effective in older people than in younger people<sup>3)</sup>. The methods of data collection and analysis may be another reason. The majority of studies from Japan examined instances of sudden death more extensively than studies from other regions. Most studies from Japan used in addition to autopsy, neuroimaging study of patients who had died suddenly or during transportation to the hospital<sup>7,11)</sup>.

To date, many reports studied the risk factors for aneurysmal SAH including hypertension, diabetes, hyperlipidemia, alcohol, smoking, extreme physical exertion and oral contraceptives, hormone replacement therapy because of overall higher incidence in women (2, 5). Many new incidence studies for aneurysmal SAH have been reported that the incidence for stroke in general has declined over the past decade, and this has been attributed to a declining proportion of people who smoke and to better detection and treatment of hypertension<sup>2,3,12)</sup>.

**CONCLUSION**

Although the survey area is restricted to the local province,

the value of this study is its first report on the incidence rate of SAH on the basis of the Korean population. In the present study, the incidence rate is 12.4 in Gwangju city, 10.7 in Jeollanamdo province and 11.8 in both areas. The incidence rate in Gwangju city was higher than the rate in Jeollanamdo province in spite of old age and female preponderance in Jeollanamdo province. Considering this unexpected result, the risk factor of aneurysmal SAH about the urban life style should be investigated.

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