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Incidences of unruptured intracranial aneurysms and subarachnoid hemorrhage: results of a statewide study

Ganesh Asaithambi, MD*, **Malik M Adil, MD**, **Saqib A Chaudhry, MD**, and **Adnan I Qureshi, MD**
Zeenat Qureshi Stroke Institute, St. Cloud, MN, USA. and University of Florida, Gainesville, FL

Abstract

Background—The incidence of unruptured intracranial aneurysms (UIAs) and the current public health impact may be higher than that reported in previous studies owing to an increase in the elderly population in the United States.

Objective—To report the current incidences of UIAs and subarachnoid hemorrhages (SAH) by using a population-based methodology.

Methods—Statewide estimates of patients admitted with UIAs and SAH were obtained from the data obtained by the Minnesota Hospital Association. We calculated the annual incidences per 100,000 persons by using the 2010 census data from the U.S. Census Bureau. For the denominator, total persons in each year were categorized into 10-year intervals.

Results—The incidences of UIAs and SAH were 15.6 and 7.7 per 100,000 persons, respectively. There were higher incidences of both UIAs and SAH among women (22.5 and 9.6 per 100,000 persons, respectively). The highest incidence of UIAs occurred in those aged between 75 and 84 years (61.6 per 100,000 persons). The highest incidence of SAH occurred in those aged 85 years and older (30.1 per 100,000 persons).

Conclusion—An increase in both incidences of UIAs and SAH can be expected owing to the continued increase of the elderly population, particularly women.

Key words

Subarachnoid hemorrhage; elderly population; epidemiology; intracranial aneurysms

Background

The overall frequency of unruptured intracranial aneurysms (UIAs) has ranged from 0.2% to 10% in the general population. However, the prevalence data is predominantly based on autopsy studies, which carry an inherent selection bias [1-–4]. Wiebers et al reported a national assessment on the incidence of UIAs based on hospital diagnosis from the years 1979, 1984, and 1989 [3]. Therefore, the incidence of UIAs may be increasing in the United States owing to an increase in the elderly population. Previous studies have demonstrated an increased prevalence of UIAs among the elderly population [5,6] According to the U.S. Census Bureau, more than 18 million people in the U.S. were 75 years or older in 2010, which is 42% greater than in 1990, the time period when the last national assessment of UIAs was undertaken [7]. Therefore, studies performed earlier may underestimate the incidence of UIAs and the current public health impact. The purpose of this study is to report the current incidences of UIAs and aneurysmal subarachnoid hemorrhages (SAH) by using a statewide assessment methodology.

Methods

We analyzed data from the Minnesota Hospital Association (MHA), which is a trade association that represents 148 hospitals in Minnesota. The methodology behind the collection of data performed by the MHA is described in a recent publication [8]. According to the U.S. Census Bureau, the estimated population of Minnesota

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*Correspondence to: Ganesh Asaithambi, Zeenat Qureshi Stroke Institute, 519 2nd St NE, St. Cloud, MN 56303, Tel: +1 320-281-5545, Fax: +1 320-281-5547, ganesh785@gmail.com

Table 1. Incidence of UIA, treatments for aneurysm, and SAH in the Minnesota population in 2011 per 100,000 persons.

Age (years)	≤24	25–34	35–44	45–54	55–64	65–74	75–84	≥85	All
UIA	0.3	3.7	8.9	22.2	32.4	47.5	61.6	51.8	15.6
Endovascular	0.1	1.6	3.6	8.3	11.1	17.1	8.7	3.8	4.8
Surgical	0.0	0.6	1.7	3.7	6.5	2.3	0.9	0.0	1.8
SAH	0.2	3.1	6.0	9.9	17.9	22.3	19.6	30.1	7.7

SAH: subarachnoid hemorrhage; UIA: unruptured intracranial aneurysm.

Table 2. Incidence of UIA, treatments for aneurysm, and SAH in the Minnesota population in 2011 among males per 100,000 persons.

Age (years)	≤24	25–34	35–44	45–54	55–64	65–74	75–84	≥85	All
UIA	0.4	1.1	4.0	13.2	19.4	26.9	37.6	43.4	8.7
Endovascular	0.1	0.6	1.4	4.9	6.7	7.9	5.4	9.3	2.6
Surgical	0.0	0.6	1.1	1.5	2.3	0.6	1.1	0.0	0.8
SAH	0.3	1.7	4.3	7.6	14.0	20.2	17.2	24.8	5.9

SAH: subarachnoid hemorrhage; UIA: unruptured intracranial aneurysm.

Table 3. Incidence of UIA, treatments for aneurysm, and SAH in the Minnesota population in 2011 among females per 100,000 persons.

Age (years)	≤24	25–34	35–44	45–54	55–64	65–74	75–84	≥85	All
UIA	0.1	6.5	14	31.3	45.2	65.9	79.3	55.5	22.5
Endovascular	0.0	2.7	5.8	11.7	15.5	25.3	11.1	1.4	7.0
Surgical	0.0	0.6	2.3	6.0	10.6	3.8	0.8	0.0	2.8
SAH	0.1	4.7	7.9	12.2	21.8	24.2	21.4	32.5	9.6

SAH: subarachnoid hemorrhage; UIA: unruptured intracranial aneurysm.

was 5,303,925 (50.3% women) in 2010 [9]. We analyzed the MHA public use data files from 2011. We used the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) codes to identify UIAs and SAH. The ICD-9-CM diagnosis codes used were 437 for UIAs and 430 for SAH. We calculated the incidence rates for UIAs per 100,000 persons. Both patients and denominator population were divided into groups based on age categorized by 10-year age intervals (<25 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, 65–74 years, 75–84 years, and ≥85 years). Persons aged younger than 25 years were grouped as one category because of low incidence, and persons aged older than 85 years were classified as one group because the census does not provide further differentiation. Race/ethnicity is not identified in the MHA data and thus was not included in our analysis. The distribution of age and sex in the residing population in Minnesota was derived from the population census of 2010. Analyses were performed using SAS software (version 9.1; SAS Institute, Cary, NC).

Results

We identified 822 patients diagnosed with UIAs and 408 patients with SAH admitted to hospitals within Minnesota in 2011. The annual incidence of UIAs was 15.6 per 100,000 persons (Table 1). The highest incidence of UIAs occurred in the persons aged 75–84 years (61.6 per 100,000 persons). The overall incidence of SAH was 7.7 per 100,000 persons. The highest rate of SAH occurred in the persons aged 85 years or older (30.1 per 100,000 persons). There were higher incidences of both UIAs and SAH among women (22.5 and 9.6 per 100,000 persons, respectively) (Tables 2 and 3).

Discussion

The average annual incidence of aneurysmal SAH is estimated to be approximately 6–7 per 100,000 persons, and the estimated prevalence of UIAs is 0.2%–10% of the general population [1-–4,10]. Our study demonstrates a similar incidence for SAH and a lower prevalence of UIAs (0.015%). There is limited data on incidence of UIAs derived from single or multicenter studies. These studies have a bias introduced through referral patterns and population served. Our study included data from all hospitals within a well-defined population.

Higher incidences of UIAs can be partly attributed to an increase in detection of UIAs with increased utilization of noninvasive brain imaging for other indications [3,4,10]. We attribute part of the current incidence of UIAs to a higher proportion of patients aged 75 years or older within the population. Our results confirmed the high incidence of UIAs among patients aged 75 years or

older. Previous longitudinal studies have also shown an increase in incidence of ruptured and UIAs among the older population [5,6]. Other considerations for increased risk of developing UIAs among the elderly include postmenopausal vulnerability among older women and longer exposure to tobacco in chronic smokers [11].

The treatment paradigm for intracranial aneurysms, particularly UIAs, may be confounded by other factors. The International Study of Unruptured Intracranial Aneurysms (ISUIA) data demonstrated that there is a strong influence of age on treatment outcomes for UIAs [12]. However, high incidences of SAH in elderly patients would suggest that untreated UIAs are not a benign entity and that further investigations are needed to provide optimal care for this age group.

With a projected $4.4 trillion expenditure on national health care spending by the year 2018, which would comprise more than 20% of the Gross Domestic Product, it is vital to analyze medical cost utilization, especially with an increasing number of persons aged 80 years and older [13]. Lawson et al noted that aneurysm treatment risk increases with age for both UIAs and ruptured aneurysms [14]. However, based on our results of increased incidences of UIAs and SAH in the older age groups compared with those in younger age groups, assessment of risk versus benefit may need to be reconsidered. Brinjikji et al reported that hospitalization costs for treatments of both ruptured and unruptured cerebral aneurysms are substantially higher than Medicare payments [15,16]. Based on our results, efforts are needed to decrease hospitalization costs or increase Medicare benefits for hospitals to support treatment interventions and optimal care for this special patient population.

We recognize that our study has limitations. Inaccuracies with coding can affect our retrospective evaluation of the database and can potentially underestimate our assessment, which can be seen with large administrative databases [17]. Thus, the retrospective design of our study is our largest limitation. Another important limitation to note is that we used the ICD-9-CM code for subarachnoid hemorrhage as there is no code for aneurysmal SAH; however, we believed that this would be an adequate representation of aneurysmal SAH because 85% of SAH are secondary to ruptured intracranial aneurysms [10].

Conclusion

In this statewide population-based estimate of UIAs and SAH, we found high incidences of both UIAs and SAH among persons aged 75 years and older, particularly women. With the anticipated increase in persons aged 75 years and older and unique risk-benefit attributed for UIAs among such patients, further studies are required to determine risk benefit ratio of treatment in this unique group of individuals.

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