Neurointervention 2021;16:201-203
https://doi.org/10.5469/neuroint.2021.00451

Unruptured Intracranial Aneurysm: Screening, Prevalence and Risk Factors

Bum-soo Kim, MD

Department of Radiology, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Subarachnoid hemorrhage (SAH) due to ruptured intracranial aneurysm is life-threatening, and screening for unruptured intracranial aneurysm (UIA) in selected patients and providing treatment before rupture of selected aneurysms are medically and economically beneficial. Therefore, screening for UIA must be tailored to specific populations in order to balance the prevalence and risk of UIA, cost-effectiveness of screening tests, and the availability of effective and safe treatment.[1,2] Of these, estimating the prevalence and risk factor of UIA by epidemiological study is methodologically challenging, requiring an optimal cohort for prospective studies with a large amount of data.[3]

In the last issue, Kim and colleagues[4] evaluated the prevalence (3.77%) and risk factors (female predominance and hypertension) of UIAs from healthy individuals who underwent brain magnetic resonance angiography using 3T magnetic resonance imaging as part of a routine health examination. There have been several other studies evaluating the prevalence and risk factors of UIA in the literature. The studies were variable with regards to the population studied, indication for imaging, and method of detection (Table 1).[4-13] The reported prevalence of UIA in the literature ranged 1.8–8.8%, and was 3.2% according to combined results from a systematic review and meta-analyses,[10] which was also similar to the result (3.77%) from Kim et al.[4] In evaluating the risk factors of UIA, it was more common in women, older age, smokers, patients with hypertension, autosomal dominant polycystic kidney disease (ADPKD), or in individuals with family history of intracranial aneurysm of SAH. Consequently, Korean Clinical Practice Guidelines for UIA currently recommended that UIA should be screened according to the following three categories;[1] 1) patients who have 2 or more first-degree relatives with an intracranial aneurysm; 2) patients with ADPKD; and 3) regular screening tests for new aneurysms for patients previously treated with aneurysmal SAH. Although the current guidelines do not support widespread screening for intracranial aneurysms in the general population, additional screening may be considered in patients with other genetic or medical conditions associated with intracranial aneurysms.[14]

Recently, according to the data from Korean National Health Insurance Service (NHIS), the number of treatments for UIA has increased because of the increased detection rate as well as increase in number of hospitals capable

Correspondence to:
Bum-soo Kim, MD
Department of Radiology, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, 222 Banpo-daero, Seocho-gu, Seoul 06591, Korea
Tel: +82-2-2258-9639
Fax: +82-2-599-6771
E-mail: bkim.neurorad@gmail.com

Received: October 5, 2021
Revised: October 14, 2021
Accepted: October 17, 2021

pISSN 2093-9043
eISSN 2233-6273

Table 1. Summary of prevalence and risk factor in occurrence of unruptured intracranial aneurysm in the literature

Author (y)	Total number	Study cohort	Prevalence	Risk factor	Modality	Country
Kim et al. (2021)[4]	2,118	Single center (health check)	3.8%	Female, hypertension	TOF MRA (3T)	Korea
Cras et al. (2020)[5]	5,841	Population-based	2.3%	Female, hypertension, smoking	TOF MRA (1.5T)	Netherland
Imaizumi et al. (2018)[6]	4,032	Single center (health check)	4.32%	Female, older age	TOF MRA (3T)	Japan
Li et al. (2014)[7]	3,993	Single center (patients)	8.8%	Female, older age	CE MRA (1.5T)	China
Park et al. (2014)[8]	18,237	Single center (health check & patients)	1.8%	Female, older female	TOF MRA (1.5T)	Korea
Li et al. (2013)[9]	4,813	Community-based cross sectional survey	7.0%	Female, older age	TOF MRA (3T)	China
Vlak et al. (2011)[10]	94,912	Systematic review and meta-analysis	3.2%	Female, older age, ADPKD, family history of SAH, pituitary adenoma, atherosclerosis, Japan, Finland	CTA, MRA, DSA	21 countries
Jeon et al. (2011)[11]	3,049	Single center (patients)	5%	Female	TOF MRA (3T)	Korea
Iwamoto et al. (1999)[12]	1,230	Community-based (30 years)	4.6%	Female	Autopsy	Japan
Ujiie et al. (1993)[13]	1,612		2.7%	Older female	DSA	Japan

TOF, time-of-flight; MRA, magnetic resonance angiography; 3T, 3-tesla; 1.5T, 1.5-tesla; CE, contrast enhanced; CTA, computed tomography angiography; DSA, digital subtraction angiography; ADPKD, autosomal dominant polycystic kidney disease; SAH, subarachnoid hemorrhage.

of performing embolization of UIA.[15] In studies analyzing data from a cohort of 1 million people from the Korean NHIS, the crude incidence of UIA increased steadily from 29.6 per 100,000 person-years in 2008,[18] to 90.0 per 100,000 person-years in 2016.[17] It is believed that this is due to an increase in the number of asymptomatic cerebral aneurysms discovered through screening rather than an increase in the number of development of cerebral aneurysms. Meanwhile, the incidence of ruptured intracranial aneurysm has decreased, which may be due to an increase in the treatment of UIA and improved management of hypertension through health screening.[16] The worldwide incidence of SAH also declined between 1980 and 2010 in Europe, Asia and North America, in parallel with a global decline in prevalence of hypertension and smoking,[17] which is also in good contrast with an increasing rate of diagnosis of UIA. However, the same study also showed increased incidence of SAH in Japan,[17] and there is another report which showed no decline of incidence of SAH in Korean.[18] Therefore, the regional or ethnic difference should also be considered for elucidating the effective relationship between the active screening and treatment of UIA, and their preventive effect for SAH.

Fund

None.

Conflicts of Interest

BK has been the Associate Editor of the *Neurointervention* since 2020. No potential conflict of interest relevant to this article was reported.

ORCID

Bum-soo Kim: https://orcid.org/0000-0002-3870-6813

REFERENCES

1. Jeong HW, Seo JH, Kim ST, Jung CK, Suh SI. Clinical practice guideline for the management of intracranial aneurysms. *Neurointervention* 2014;9:63-71

2. Thompson BG, Brown RD Jr, Amin-Hanjani S, Broderick JP, Cockroft KM, Connolly ES Jr, et al.; American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, and Council on Epidemiology and Prevention; American Heart Association; American Stroke Association. Guidelines for the management of patients with unruptured intracranial aneurysms: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2015;46:2368-2400
3. Korja M, Kaprio J. Controversies in epidemiology of intracranial aneurysms and SAH. *Nat Rev Neurol* 2016;12:50-55
4. Kim JH, Lee KY, Ha SW, Suh SH. Prevalence of unruptured intracranial aneurysms: a single center experience using 3T brain MR angiography. *Neurointervention* 2021;16:117-121
5. Cras TY, Bos D, Ikram MA, Vergouwen MDI, Dippel DWJ, Voortman T, et al. Determinants of the presence and size of intracranial aneurysms in the general population: the Rotterdam study. *Stroke* 2020;51:2103-2110
6. Imaizumi Y, Mizutani T, Shimizu K, Sato Y, Taguchi J. Detection rates and sites of unruptured intracranial aneurysms according to sex and age: an analysis of MR angiography-based brain examinations of 4070 healthy Japanese adults. *J Neurosurg* 2018;130:573-578
7. Li J, Shen B, Ma C, Liu L, Ren L, Fang Y, et al. 3D contrast enhancement-MR angiography for imaging of unruptured cerebral aneurysms: a hospital-based prevalence study. *PLoS One* 2014;9:e114157
8. Park S, Lee DH, Ryu CW, Pyun HW, Choi CG, Kim SJ, et al. Incidental saccular aneurysms on head MR angiography: 5 years' experience at a single large-volume center. *J Stroke* 2014;16:189-194
9. Li MH, Chen SW, Li YD, Chen YC, Cheng YS, Hu DJ, et al. Prevalence of unruptured cerebral aneurysms in Chinese adults aged 35 to 75 years: a cross-sectional study. *Ann Intern Med* 2013;159:514-521
10. Vlak MH, Algra A, Brandenburg R, Rinkel GJ. Prevalence of unruptured intracranial aneurysms, with emphasis on sex, age, comorbidity, country, and time period: a systematic review and meta-analysis. *Lancet Neurol* 2011;10:626-636
11. Jeon TY, Jeon P, Kim KH. Prevalence of unruptured intracranial aneurysm on MR angiography. *Korean J Radiol* 2011;12:547-553
12. Iwamoto H, Kiyohara Y, Fujishima M, Kato I, Nakayama K, Sueishi K, et al. Prevalence of intracranial saccular aneurysms in a Japanese community based on a consecutive autopsy series during a 30-year observation period. The Hisayama study. *Stroke* 1999;30:1390-1395
13. Ujiie H, Sato K, Onda H, Oikawa A, Kagawa M, Takakura K, et al. Clinical analysis of incidentally discovered unruptured aneurysms. *Stroke* 1993;24:1850-1856
14. Toth G, Cerejo R. Intracranial aneurysms: review of current science and management. *Vasc Med* 2018;23:276-288
15. Lee SU, Kim T, Kwon OK, Bang JS, Ban SP, Byoun HS, et al. Trends in the incidence and treatment of cerebrovascular diseases in Korea: part I. Intracranial aneurysm, intracerebral hemorrhage, and arteriovenous malformation. *J Korean Neurosurg Soc* 2020;63:56-68
16. Lee JH, Yang DH, Park HS, Cho Y, Jun JE, Park WH, et al.; HYpertension-Diabetes Daegu Initiative Study Investigators. Incidence of hypertension in Korea: 5-year follow-up study. *J Korean Med Sci* 2011;26:1286-1292
17. Etminan N, Chang HS, Hackenberg K, de Rooij NK, Vergouwen MDI, Rinkel GJE, et al. Worldwide incidence of aneurysmal subarachnoid hemorrhage according to region, time period, blood pressure, and smoking prevalence in the population: a systematic review and meta-analysis. *JAMA Neurol* 2019;76:588-597
18. Suh SH. The annual trends between neurointerventional and neurosurgical procedures in Korea: analysis using HIRA data from 2010 to 2016. *Neurointervention* 2017;12:77-82