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Original Article

Socio-demographic factors and lifestyle associated with symptomatic hemorrhoids: Big data analysis using the National Health insurance Service-National Health screening cohort (NHIS-HEALS) database in Korea

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SUMMARY

Objective: The prevalence of hemorrhoids has been reported to be 7–14%. However, there have been no large-scale studies. This study aims to investigate the incidence of hemorrhoids in Korea by analyzing big data and to find the associated risk factors.
Methods: This was a retrospective analysis using the Health Insurance Cohort database of the National Health Insurance Corporation of Korea in 2002–2015. The study was divided into two models: the diagnostic (DM) and surgical model (SM). Socio-demographic and lifestyle behavioral characteristics were analyzed as risk factors.
Results: Overall, 467,567 participants were included. The incidence density of hemorrhoids was 13.9 and 5.7 per 1000 person-years in the DM and SM, respectively. Hemorrhoids occurred more frequently in men and metropolitan areas in both models. The incidence was highest in the 40s. The incidence rates were highest in the high income, smoking, alcohol and the exercise group of 1–4 times a week in both models. The adjusted hazard ratio (HR) was higher in men and decreased with increasing age. It was higher in the metropolitan area. The high-income level and alcohol consumption were risk factors in the DM and SM, respectively. The HR of the exercise group was higher than that of the non-exercise group in both models.
Conclusions: The diagnostic and surgical incidence density was 13.9 and 5.7 per 1000 person-years, respectively. Hemorrhoids occurred most frequently in men in their 40s. The metropolitan area, high income level and alcohol consumption were associated with an increased frequency of hemorrhoids.

Conflicts of interest and source of funding

No potential conflict of interest relevant to this article is reported.

Introduction

Hemorrhoids are known as normal blood vessels, a normal part of the anorectal anatomy.[1] Symptomatic hemorrhoids result from enlargement and/or protrusion of the anal hemorrhoidal cushions.[2] The prevalence of hemorrhoids varies depending on the study and ranges from 4.4% to 38.9%.[3,4] In a recent study based on the National Health and Nutrition Survey in Korea, 14.4% of respondents said that they had hemorrhoids, and 7.2% were diagnosed with hemorrhoids.[5] In 2019, the number of patients treated for hemorrhoids in Korea was 161,143, the fifth-largest number of inpatients.[6]

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Additionally, the total amount of medical care benefits used for the treatment of hemorrhoids in Korea accounted for approximately US$ 172 million in 2018.[6]

Socio-demographic characteristics such as sex, race, educational background, and socioeconomic level[4,7–10] and lifestyle behaviors such as obesity, alcohol intake, tobacco consumption, diet, exercise, and bowel movements are known risk factors for hemorrhoids.[11] Additionally, many studies have reported that physical activity, obesity, bowel movements, diet, and alcohol intake are the causes of hemorrhoids.[3,8–10,12,13] In contrast, some studies have reported that these demographic characteristics and lifestyle behaviors[3,7,8] are not related to hemorrhoids.[8,13,14] This difference is because most of the previous studies were case-control or cross-sectional studies, and there were few big data studies.

This study aims to identify the incidence rate of symptomatic hemorrhoids in Korea using the National Health Insurance Service-National Health Screening Cohort (NHIS-HEALS) big data and the risk factors associated with symptomatic hemorrhoids among socio-demographic characteristics and lifestyle behaviors.

Methods

Data

This study retrospectively analyzed the data of people selected from the NHIS-HEALS database in Korea. We used simple randomized data of 510,000 of the 5.15 million adults aged 40–79 years who received health checkups from 2002 to 2003.[15] These data included health checkup data and medical institution use data from 2002 to 2015 of citizens enrolled in National Health Insurance.[15] The study was approved by the institutional review board of Hanyang University (IRB approval number: HYI-18-230), and the study was performed according to the Helsinki Declaration.

Participants

The total number of participants in the National Health Screening Cohort Database was 514,866. Among them, those diagnosed with symptomatic hemorrhoids in 2002 and 2003, those who underwent surgery, those who died in 2003, and those with missing values for variables during the observation period were excluded from the study. Finally, 467,742 participants satisfied the inclusion criteria.

Variables

Lifestyle behavioral variables included body mass index (BMI), alcohol intake, smoking, and exercise. The patients were classified into the following groups based on BMI (kg/m^2): underweight (<18.5), normal weight (18.5–23), overweight (23–25), and obesity (≥25).[16] Exercise variables were divided into three groups: <1 time a week, 1–4 times a week, and ≥5 times a week. Socio-demographic variables included age, sex, residential area, and income level. The residential area was divided into metropolitan areas and cities, of which metropolitan areas were defined as cities with a population of >1 million. The income level was divided into three groups based on income divided by the tenth quintile. The top first and third quartiles were classified as high-income, the fourth and seventh quintiles were middle-income, and the eight and tenth quartiles were classified as low-income.

We divided the data into a diagnostic model (DM) and a surgical model (SM) to determine the diagnostic rate and operation frequency of hemorrhoids. The incidence of hemorrhoids in the DM was defined as the primary diagnosis assigned to hemorrhoids from 2004 to 2015. In the DM, hemorrhoid diagnosis is indicated by code I84 according to the Korean Standard Classification of Diseases (KCD) based on the International Statistical Classification of Diseases and Related Health Problems-10 code (ICD-10 code). The date of diagnosis of hemorrhoids was defined as the date of medical treatment when the hemorrhoid diagnosis code was received (code I84).

In the SM, hemorrhoid treatment was defined as a record of a fee-for-service code and treatment date. The fee-for-service code for hemorrhoids in the SM included thrombectomy and excision of the skin tag (Q3015); surgery for strangulated circumferential hemorrhoids (Q3014); thrombosed hemorrhoid surgery (Q3012); coagulation, cauterization, sclerotherapy, and rubber band ligation (Q3016); circular stapled hemorrhoidectomy (Q3017); and hemorrhoidectomy (Q3013).

Statistical analyses

Basic statistical analysis using descriptive statistics and the chi-square test was conducted to understand the demographic characteristics of the participants. The incidence density was calculated as a 95% confidence interval using Poisson regression analysis, and the incidence rates for each variable were compared during the

Table 1
Demographic characteristics of the research cohort.

Variables	N (467,567)	%
Age (years) [a]		
40s	214,851	46.0
50s	131,784	28.2
60s	92,156	19.7
70s	28,776	6.2
Sex		
Male	251,618	53.8
Female	215,949	46.2
Area		
Metropolitan[b]	206,158	44.1
City	261,409	55.9
Income level		
Low	104,691	22.4
Middle	152,978	32.7
High	209,898	44.9

[a] The base year is 2002.
[b] Seoul, Busan, Incheon, Daejeon, Daegu, Gwangju, Ulsan.

Table 2
Mortality, Incidence, and Observation period in Diagnostic and Surgical models.

	Diagnostic model[a]		Surgical model[b]	
Total (N)	467,567		467,567	
All causes mortality (N, %)				
No	425,176	90.9%	425,176	90.9%
Yes	42,391	9.1%	42,391	9.1%
Incidence (N, %)				
No	394,448	84.4%	436,152	93.3%
Yes	73,119	15.6%	31,415	6.7%
Event period (years)				
Mean (SD)[3]	6.3	±3.4	6.3	±3.3
Median	6.0		6.0	
Censored period (years)				
Mean (SD)	12.2	±2.1	12.3	±2.1
Median	12.9		12.9	
Total observation period (years)				
Mean (SD)	11.3	±3.2	11.8	±2.6
Median	12.9		12.9	

SD, standard deviation.
[a] The definition of hemorrhoids is according to the Korean standard classification of disease.
[b] The definition of hemorrhoids is according to the procedure claim data (surgical treatment).

Table 3
Incidence density of hemorrhoid-associated risk factors.

Variables	Diagnostic model[a]				Surgical model[b]			
	Event	PY[4)]	Incidence[c] (95% CI) per 1000 PY		Event	PY	Incidence (95% CI) per 1000 PY	
Sex								
Male	41,706	2,786,957	15.0	(14.8–15.1)	18,033	2,933,970	6.1	(6.1–6.2)
Female	31,413	2,491,343	12.6	(12.5–12.8)	13,382	2,604,155	5.1	(5.1–5.2)
Age (years)								
40s	38,328	2,451,883	15.6	(15.5–15.8)	18,087	2,581,034	7.0	(6.9–7.1)
50s	20,964	1,511,388	13.9	(13.7–14.1)	8911	1,586,435	5.6	(5.5–5.7)
60s	11,504	1,030,073	11.2	(11.0–11.4)	3817	1,076,139	3.5	(3.4–3.7)
70s	2323	284,955	8.2	(7.8–8.5)	600	294,516	2.0	(1.9–2.2)
Area								
Metropolitan	34,137	2,332,545	14.6	(14.5–14.8)	15,297	2,451,382	6.2	(6.1–6.3)
Cities	38,982	2,945,754	13.2	(13.1–13.4)	16,118	3,086,743	5.2	(5.1–5.3)
Income								
Low	14,509	1,176,389	12.3	(12.1–12.5)	6347	1,224,726	5.2	(5.1–5.3)
Middle	23,061	1,731,914	13.3	(13.1–13.5)	10,087	1,812,097	5.6	(5.5–5.7)
High	35,349	2,369,997	15.0	(14.8–15.2)	14,981	2,501,302	6.0	(5.9–6.1)
BMI (kg/m^2)								
Low (<18.5)	1370	119,213	11.5	(10.9–12.1)	563	123,924	4.5	(4.2–4.9)
Normal (18.5–23)	25,754	1,853,110	13.9	(13.7–14.1)	11,400	1,942,159	6.0	(5.8–6.0)
Over (23–25)	20,716	1,437,762	14.4	(14.2–14.6)	8854	1,512,028	5.9	(5.7–6.0)
Obesity (≥25)	25,279	1,868,215	13.5	(13.4–13.7)	10,598	1,960,013	5.4	(5.3–5.5)
Smoking								
No	49,364	3,568,104	13.8	(13.7–14.0)	20,621	3,749,097	5.5	(5.4–5.6)
Yes	23,755	1,710,195	13.9	(13.7–14.1)	10,794	1,789,028	6.0	(5.9–6.1)
Alcohol								
No	40,190	3,030,335	13.3	(13.1–13.4)	16,603	3,177,488	5.2	(5.1–5.3)
Yes	32,929	2,247,965	14.7	(14.5–14.8)	14,812	2,360,677	6.2	(6.1–6.4)
Exercise								
No	39,546	3,037,335	13.0	(12.9–13.2)	16,827	3,177,095	5.3	(5.2–5.4)
1–4 days/week	26,508	1,741,882	15.2	(15.0–15.4)	11,714	1,835,667	6.4	(6.3–6.5)
≥5 days/week	7065	499,083	14.2	(13.9–14.5)	2874	525,363	5.5	(5.3–5.7)

PY, person-year; BMI, body mass index; CI, confidence interval.
[a] The definition of hemorrhoids is according to the Korean standard classification of disease.
[b] The definition of hemorrhoids is according to the procedure claim data (surgical treatment).
[c] Incidence density (per 1000 person-years).

observation period. The Cox proportional hazard model was applied to show the hazard ratio (HR) as a 99% confidence interval.[17] For ordinal variables, a trend test was performed on the final model for determining the trend, and statistical significance was tested with a significance level of 1%. Statistical analyses were performed using SAS Enterprise Guide 7.13 (SAS Institute, Cary, NC, USA).

Results

General characteristics

Overall, 467,567 patients were finally enrolled. Among them, participants in their 40s (46.0%) were the most common, and men (53.8%) were more frequent than women (46.2%). Of these, 44.1% lived in metropolitan areas, and 55.9% lived in cities. The number of high-income groups was the highest (44.9%), followed by the middle (32.7%) and low-income groups (22.4%) (Table 1).

In the DM, 73,119 patients were diagnosed with hemorrhoids over 13 years, and the cumulative incidence rate was 15.6%. During the total observation period, 42,403 people died, and the all-cause mortality was 9.1%. The mean observation period of the diagnosed patients was 6.3 ± 3.4 years, and the median value was 6 years. The mean observation period of censored data was 12.2 ± 2.1 years, and the median value was 12.9 years. The average of the total observation period was 11.3 ± 3.2 years, and the median was 12.9 years.

In the SM, 31,415 patients underwent surgery, and the cumulative incidence rate was 6.7%. The all-cause mortality rates were the same as those in DM group. The mean observation period of the surgical patients was 6.3 ± 3.3 years, and the median was 6 years. The average observation period of dropouts was 12.3 ± 2.1 years, and the median was 12.9 years. The total observation period was 11.8 ± 2.6 years, and the median was 12.9 years (Table 2).

Hemorrhoid incidence in the DM

The incidence density of hemorrhoids in men was 15.0 per 1000 person-years and that in women was 12.6 per 1000 person-years. The incidence density by age was the highest in the 40s at 15.6 per 1000 person-years, which decreased with increasing age. The incidence density by metropolitan areas was higher than that by cities (14.6 vs. 13.2 per 1000 person-years). As the income level increased, the incidence density of hemorrhoids increased (12.3 vs. 13.3 vs. 15.0 per 1000 person-years) (Table 3).

The incidence density of hemorrhoids according to BMI was the highest for the overweight group (14.4 per 1000 person-years); that of the smoking and non-smoking groups was 13.8 (13.7–14.0) and 13.9 (13.7–14.1), respectively. The incidence density of the non-drinking and drinking groups was 13.3 and 14.7, respectively. In the exercise group of 1–4 days a week, the incidence was the highest (15.2 per 1000 person-years) (Table 3).

Hemorrhoid incidence in the SM

The incidence density of hemorrhoid surgery in men and women was 6.1 and 5.1 per 1000 person-years, respectively. It was

Table 4
Hazard ratio of hemorrhoid-associated risk factors.

	Diagnostic model[a]			Surgical model[b]		
Variables	Crude HR[3)] (99% CI)[4]	Adjusted HR (99% CI)	p for trend[5]	Crude HR (99% CI)	Adjusted HR (99% CI)	p for trend
Sex						
Male	1.188 (1.166–1.211)	1.238 (1.208–1.268)		1.195 (1.161–1.231)	1.159 (1.116–1.204)	
Female	Ref.	Ref.		Ref.	Ref.	
Age (years)[6]			<0.001			<0.001
40s	1.914 (1.812–2.022)	1.841 (1.742–1.947)		3.449 (3.099–3.837)	3.264 (2.931–3.635)	
50s	1.698 (1.605–1.796)	1.649 (1.558–1.746)		2.765 (2.481–3.082)	2.651 (2.377–2.956)	
60s	1.367 (1.289–1.449)	1.348 (1.271–1.429)		1.744 (1.557–1.953)	1.712 (1.529–1.917)	
70s	Ref.	Ref.		Ref.	Ref.	
Area						
Metropolitan[7]	1.107 (1.086–1.128)	1.056 (1.036–1.077)		1.195 (1.161–1.230)	1.122 (1.090–1.156)	
City	Ref.	Ref.		Ref.	Ref.	
Income			<0.001			0.045
Low	Ref.	Ref.		Ref.	Ref.	
Middle	1.080 (1.051–1.110)	1.030 (1.002–1.059)		1.074 (1.031–1.119)	1.000 (0.959–1.042)	
High	1.217 (1.186–1.248)	1.123 (1.094–1.152)		1.156 (1.112–1.202)	1.026 (0.987–1.068)	
BMI (Kg/m^2)[8)]			0.001			<0.001
Low (<18.5)	Ref.	Ref.		Ref.	Ref.	
Normal (18.5–23)	1.207 (1.124–1.296)	1.121 (1.044–1.205)		1.292 (1.156–1.444)	1.157 (1.035–1.293)	
Over (23–25)	1.251 (1.164–1.344)	1.139 (1.060–1.224)		1.290 (1.153–1.442)	1.136 (1.015–1.271)	
Obesity (≥25)	1.175 (1.094–1.262)	1.076 (1.002–1.156)		1.191 (1.065–1.331)	1.061 (0.949–1.186)	
Smoking						
No	Ref.	Ref.		Ref.	Ref.	
Yes	1.004 (0.984–1.025	0.838 (0.817–0.859)		1.096 (1.063–1.130)	0.905 (0.871–0.940)	
Alcohol						
No	Ref.	Ref.		Ref.	Ref.	
Yes	1.106 (1.085–1.127)	1.003 (0.980–1.026)		1.200 (1.166–1.236)	1.052 (1.016–1.089)	
Exercise			<0.001			<0.001
No	Ref.	Ref.		Ref.	Ref.	
1–4 days/week	1.169 (1.145–1.193)	1.068 (1.045–1.091)		1.205 (1.168–1.243)	1.065 (1.031–1.100)	
≥5 days/week	1.087 (1.052–1.124)	1.071 (1.036–1.107)		1.033 (0.981–1.088)	1.043 (1.004–1.099)	

HR, Hazard ratio; CI, confidence interval; p for trend, predictive value for trend test.
[a] The definition of hemorrhoids is according to the Korean standard classification of disease.
[b] The definition of hemorrhoids is according to the procedure claim data (surgical treatment).

the highest in the 40s (7.0 per 1000 person-years), which decreased with increasing age. The incidence density by metropolitan areas was higher than that by cities (6.2 vs. 5.2 per 1000 person-years). The higher the income level, the higher was the incidence density (5.2 vs. 5.6 vs. 6.0 per 1000 person-years) (Table 3).

The incidence densities of the normal and overweight groups were 6.0 and 5.9 per 1000 person-years, respectively. They were 6.0 per 1000 person-years for the smoking group and 6.2 per 1000 person-years for the non-smoking group. The incidence of surgery in the exercise group of 1–4 days a week was the highest when compared with the other groups (Table 3).

Risk factors associated with hemorrhoids

The adjusted HR according to sex was 1.238 (1.208–1.268) in the DM group and 1.159 (1.116–1.204) in the SM group. In both the DM and SM, men had a higher risk of incidence than women (Table 4).

In the DM, the adjusted HR according to age was the highest in the 40s [1.841 (1.742–1.947)], and the incidence of hemorrhoids significantly decreased with increasing age (p for trend <0.001). In the SM, the adjusted HR for the 40s [3.264 (2.931–3.635)] was higher than that for other age groups, and the incidence of hemorrhoids decreased with increasing age (p for trend <0.001) (Table 4). The adjusted HR, according to age, was greater in the SM group than in the DM group (1.841 [1.742–1.947] vs. 3.264 [2.931–3.635]).

In both models, the adjusted HR according to metropolitan areas was significantly higher than that according to cities. There was a greater difference in the SM than in the DM (1.056 [1.036–1.077] vs. 1.122 [1.090–1.156]) (Table 4). The adjusted HR of the DM according to income level increased as the income increased (p for trend <0.001). The adjusted HR of the SM tended to increase with increasing income, but there was no statistically significant difference (p for trend = 0.045).

The adjusted HR of the DM according to BMI (kg/m^2) was higher in the other groups than in the underweight group (1.121 [normal], 1.139 [overweight], 1.076 [obese]) (Table 4). In the SM, the adjusted HR of the normal [1.157 (1.035–1.293)] and overweight groups [1.136 (1.015–1.271)] was significantly higher than that of the underweight group. As the BMI increased, the frequency of hemorrhoid surgery significantly decreased (p for trend <0.001) (Table 4).

In both the models, the frequency of hemorrhoids in the smoking group was meaningfully lower than that in the non-smoking group [0.838 (0.817–0.859) in the DM group and 0.905 (0.871–0.940) in the SM group]. The frequency of hemorrhoid surgery was higher in the drinking group than in the non-drinking group (1.052 [1.016–1.089]) (Table 4).

In the DM, hemorrhoids occurred more frequently as the number of exercises per week increased (p for trend<0.001). The frequency of hemorrhoid surgery was higher in the exercise group than in the non-exercise group (p for trend <0.001) (Table 4).

Discussion

To date, there have been no accurate statistics on the prevalence of hemorrhoids and the frequency of surgery for a large Korean population. Our study has great significance because the prevalence of hemorrhoids and the frequency of surgery in Korea were found using big data analysis. Particularly, the reliability of the data is very high; the data used in our study are health screening and

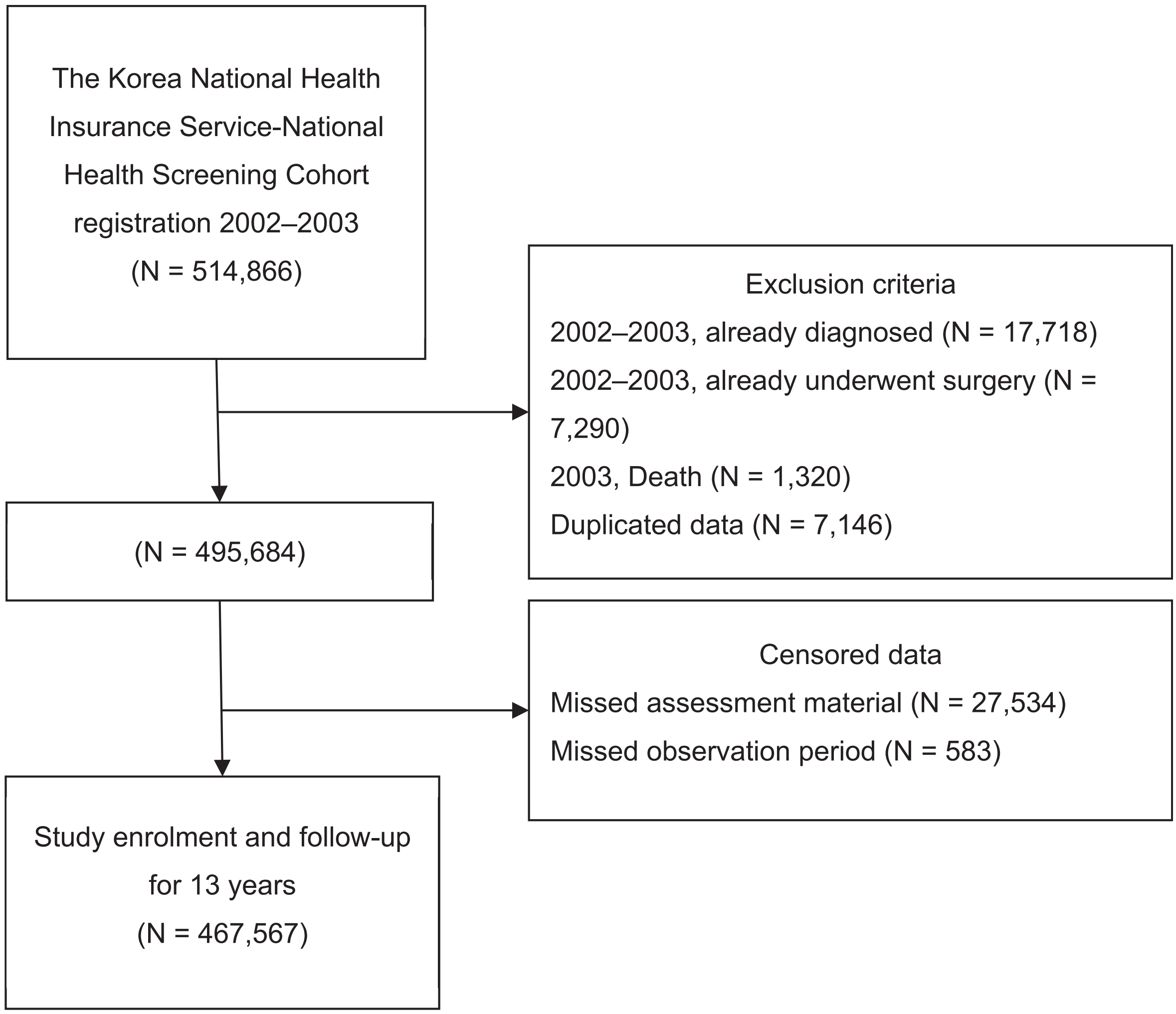

Fig. 1. Flowchart showing the inclusion and exclusion of the study participants.
Fig. 1. Study enrolment and follow-up for 13 years (N = 467,567).

health insurance data from the National Health Insurance Corporation.[15] Additionally, our study is very reliable because the number of participants was large, and it involved big data with a longer study period. Participants included in our study were a cohort randomly extracted from the 5.15 million adults, and the observation period was 14 years.

The cause of hemorrhoids remains unknown.[18] Although there have been several studies on the pathophysiologic causes of hemorrhoids, few studies have examined the relationship between socio-demographic and lifestyle factors and symptomatic hemorrhoids. Our study is meaningful, wherein it revealed that various socio-demographic factors and lifestyle behaviors are associated with symptomatic hemorrhoids. Therefore, our results could be used as basic socio-demographic data for the hemorrhoidal disease. However, further studies on the relationship between risk factors and exposure time are needed.

In our study, the cumulative incidence rate of hemorrhoids in Korea for 13 years was 15.6%, and the frequency of surgery was 6.7%. The average incidence density was 13.9 per 1000 person-years based on diagnosis and 5.7 per 1000 person-years based on surgery. In previous studies on the prevalence of hemorrhoids, 14.4% of the respondents answered that they might have hemorrhoids, and only 7.2% were diagnosed at a hospital.[8] However, this is the result of a single institution's survey and not big data analysis, with a limitation of a relatively small sample size. Another study reported that the average incidence rates of hemorrhoids in the US and UK were 1.2% and 1.1%, respectively.[9] These results are similar to that of 1.39% (13.9 per 1000 person-years) for 13 years in our study. The frequency of hemorrhoid surgery in the US between 1983 and 1987 was 49 per 100,000 person-years,[9] and it was 515 per 100,000 person-years in Korea. This difference is probably due to various reasons, such as study periods, medical insurance systems, and social and cultural differences.

Approximately 43% of patients diagnosed with hemorrhoids in the DM underwent surgery (DM: 15.6% vs. SM: 6.7%), representing indications for surgery.[19,20] There have been various studies related to sex and hemorrhoids.[3,8,9] One study reported the difference according to the behavior of visiting medical institutions.[21] Other studies have reported that the participation rate of economic activities is related to sex differences.[22,23] In our study, the incidence of hemorrhoids and HR was higher in men than in women.

Some studies have reported that the prevalence of hemorrhoids is higher in people who engage in physical labor and high-intensity physical activity, being affected by the frequency and intensity of exercise.[8,24] In both models, the incidence rate and HR of hemorrhoids in the exercise group were higher than those in the non-exercise group. Particularly, the HR increased as the number of weekly exercises increased in the DM, and this result shows that the frequency of exercise is related to hemorrhoids. In the subgroup analysis, the frequency of regular exercise was higher in men (50.4%) than in women (33.1%). This is thought to be related to a higher frequency of hemorrhoids in men.

The incidence density and risk of hemorrhoids increased in the younger population, with the highest in the 40s (p for trend <0.001). This was similar to a previous study reporting that hemorrhoids occur most frequently in the 40s (18.3%) and the frequency gradually decreases with age over 60 years (14.2%) in Korea.[8] In our study, the frequency of surgery also decreased with age (p for trend <0.001). Our result is consistent with that of previous studies in which surgery was performed passively owing to the increased risk of surgery and postoperative complications with age. These results are consistent with those of previous reports, which show that with increasing age, surgery is passively performed because of concerns regarding complications.[25]

The difference in the accessibility of medical institutions is thought to be related to the high incidence of hemorrhoids in metropolitan areas. A previous study reported that the number of medical institutions and medical institutions per population made a difference in medical accessibility.[26] In our study, there was no difference in the frequency of hemorrhoid surgery according to income; however, the frequency of the diagnosis of hemorrhoids was higher in the higher income group (HR 1.123). Our findings are supported by those of previous reports where health care utilization was related to income levels, indicating that lower-income levels may be vulnerable to the use of healthcare facilities.[27] This is because the low-income group does not receive active treatment in the early stage, while the high-income group receives it earlier.

In the DM, there was no statistical relationship between alcohol consumption and hemorrhoids; however, the frequency of surgery in the drinking group was significantly higher. It seems that drinking is an important risk factor for exacerbating the symptoms of hemorrhoids that have already occurred, rather than affecting their occurrence.[10]

While some studies have reported that smoking is not associated with hemorrhoids,[8,13] our study has shown that the incidence of hemorrhoids is lower in the smoking group. We found that smoking was related to the reduction in the incidence of hemorrhoids in men in both the models using sex stratification analysis (DM, HR 0.847; SM, HR 0.916) but was not related to that in women (DM, HR 0.942; SM, HR 1.003). This result is thought to be due to the difference in smoking rates.

Our study has several limitations. First, there were few variables of lifestyle behavior included in our study. It is thought that the analysis of risk factors such as pregnancy, childbirth, and diet is necessary in the future. Second, the exercise variables did not include detailed factors such as the type and intensity of exercise. Third, lifestyle changes during the observation period were not reflected in this study. In this respect, there may be limitations to clinical application. Forth, private insurance was not included as a variable in this study. Although our database can minimize the risk of potential benefits from insurance, private insurance should also be considered as risk factors. We propose a large-scale study that includes these variables. Despite these limitations, our study has great implications. It is a long-term big data analysis reporting the incidence of symptomatic hemorrhoids and the frequency of surgery in Koreans. It also has an important value epidemiologically: it is the first cohort study to report the relationship among sociodemographic factors, lifestyle behaviors, and hemorrhoids in Koreans.

In conclusion, the cumulative incidence of symptomatic hemorrhoids for 13 years in Korea was 15.6%, and the frequency of surgery was 6.7%. The average incidence rate was 13.9 per 1000 person-years, and the frequency of surgery was 5.7 per 1000 person-years. The incidence of symptomatic hemorrhoids was high in men in their 40s, living in metropolitan areas. The higher the income and the higher the number of weekly exercises, the higher was the incidence of hemorrhoids. The frequency of surgical treatment was higher in the exercise and drinking groups than in the non-exercise and non-drinking groups. Fig. 1

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