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Is septal deviation associated with headache?

A nationwide 10-year follow-up cohort study

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Abstract

To investigate the potential relationship between septal deviation (SD) and headache using nationwide representative cohort sample data.

This study used a nationwide cohort sample from the Korean National Health Insurance Service database. The cohort sample was composed of 1 million patients, which is obtained by propensity score matching from 2002 to 2013. There were 9171 individuals in the SD group and 28243 in the control or no SD group. The Kaplan–Meier survival analysis, the log-rank test, and Cox proportional hazard regression analysis were used to calculate the incidence, survival curve, and hazard ratio of headache for each group.

There were no statistically significant differences in sex ($P = .7708$), age ($P = .991$), residential area ($P = .9626$), or socioeconomic status ($P = .9982$) between the 2 groups. The survival curve between SD and control or no SD showed a statistically significant difference. The adjusted hazard ratio for headache incidence during the 10-year follow-up period of the SD group was 1.37 (95% CI: 1.31-1.43).

This cohort study suggests that SD is associated with headache. Therefore, these findings suggest that septoplasty can be considered as 1 of the treatment option in SD patients with headache.

Abbreviations: HR = hazard ratio, KNHIS-NSC = Korea National Health Insurance Service-National Sample Cohort, non-SD = control or no septal deviation, SD = septal deviation.

Keywords: deviated nasal septum, headache, septal deviation

1. Introduction

Septoplasty is a method of surgical correction of deviated nasal septum, which is 1 of the most common surgery in ear nose throat. The septic deviation and inferior turbinate hypertrophy are the predominant conditions that can cause nasal obstruction. These septoplasty has been known as a common treatment for nasal obstruction with turbinoplasty.[1]

Although septoplasty is an effective surgical procedure for nasal obstruction, current literature on its efficacy is rare and often inconclusive. (2) Some literature reports that the prevalence of septal deviation (SD) is approximately 80%, however, among these patients, few patients complain of nasal obstruction until some events such as trauma or upper respiratory tract infection occurs.[2]

So what about the relationship between SD and headache?

When the nasal septum is deviated, the septum on the convex side touches the mucosa of the peripheral nasal wall of the inferior turbinate or middle turbinate, or the lateral nasal wall of the nasal septum. This mucosal contact point may cause pain along the end of the sensory nerve.[3] It is reported that in such rhinogenic headaches, surgical treatment is more effective than medical treatment;[4–6] however, the occurrence of these headaches may not be reduced even with surgical treatment.[7,8]

In this regards, it will be interesting to conduct a nationwide cohort study of the association between headaches and SD.

2. Methods

2.1. Database

This study passed the Institutional Review Board of Chonbuk National University Hospital (IRB number 2019-04-010). Since the patient's individual information is not included in this study, informed consent from patient was waived. The Korea National Health Insurance Service-National Sample Cohort (KNHIS-NSC) database is anonymized and stores the resident registration

Editor: Wen-Jun Tu.

SHK, EJL, CDY, and MGK contribute equally.

This paper was supported by a fund of the Biomedical Research Institute at Jeonbuk National University Hospital and and by research funds for newly appointed professors of Jeonbuk National University in 2018 (J.S.K).

The authors have no conflicts of interest to disclose.

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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How to cite this article: Kwon SH, Lee EJ, Yeo CD, Kim MG, Kim JS, Noh SJ, Kim EJ, Kim SG, Lee JH, Yoo JS, Koh Jh, Kim BJ. Is septal deviation associated with headache? A nationwide 10-year follow-up cohort study. Medicine 2020;99:20(e20337).

Received: 11 November 2019 / Received in final form: 17 April 2020 / Accepted: 20 April 2020

http://dx.doi.org/10.1097/MD.0000000000020337

number of each individual in place of the unique identification number. In addition, KNHIS-NSC includes information such as a patient's age, sex, income, residential area, medical expenses, and so on, and related diagnostic codes, medical history, prescription history, and prescription details. This database includes almost all Koreans in the country, and the code for the disease (Korean Classification of Diseases) is based on the International Classification of Diseases, Tenth Revision. Around 1 million individuals were randomly selected in a cohort based on this database, representing a total population of 50 million.

2.2. SD population

Patients who were diagnosed with a deviated nasal septum (code J342) between January 1, 2002 and 31 December 2003 were included in the study population. To improve the accuracy of diagnosis, patients were limited to those who had undergone nasal examination by endoscopy (procedure codes: E7560, E7550, E7540, E7530).

Exclusion criteria were as follows: Patients undergoing functional endoscopic sinus surgery, septoplasty, or turbinoplasty between January 1, 2002 and December 31, 2003.

2.3. Control (non-SD) population

Subjects with similar age, sex, residential area, and economic status as the SD cohort, again from January 1, 2002 to December 31, 2003, were selected as a control group through 1:3 propensity score matching. The matching ratio was adjusted by applying the hybrid system in the same way so that the assignment ratios were not the same for all treatment groups.[9] The index for the control group was patients not having code J342, that is, patients without SD disease.

2.4. Follow-up

The patients (SD group) and control or no SD (non-SD group) were examined by follow-up for 10 years from January 1, 2004 to December 31, 2013 to determine whether the primary end point, headache, had occurred. Considering that it is difficult to include a rhinogenic headache when evaluating the patients, we considered a broad headache syndrome by including G43 (migraine), G44 (headache), or R51 (other headache). Follow-up was based on the duration of headache. The difference between the date of the first SD diagnosis and the date of headache was calculated as the time period until the headache occurred.

2.5. Outcome variables and statistical analysis

Our study divided the population between January 1, 2002 and December 31, 2003 into the SD group and the non-SD group, and checked the occurrence of headache in each group for 10 years thereafter. The detailed age, sex, residential area, and socioeconomic status of each group were obtained from the KNHIS-NSC database. The sex of the patient was male or female, and the hazard ratio (HR) of the female was calculated based on the male. Patients were divided into 4 groups: those younger than 20 years, those aged 20 to 40, those aged 40 to 60, and those aged 60 or older. The residential areas were divided into 3 groups (Metropolitan, Urban and Rural). The socioeconomic status was divided into 3 groups of low (less than 30 quartile), middle (30–70 quartile), and high (70 quartile and above).

Data analysis was conducted between January and April 2019. The Kaplan–Meier survival curve was used for univariate survival analysis, and the log-rank test was used to compare the differences between the SD and non-SD groups. Multivariate survival analysis used Cox proportional hazard regression analysis to examine the relationships with other variables. All statistical analyses were performed using *R* version 3.5.3 and STATA version 14.

3. Results

3.1. Baseline demographics

The basic demographic information is summarized in Table 1. There were 9171 individuals in the SD group and 28243 in the non-SD group. There were no statistically significant differences in sex ($P = .7708$), age ($P = .991$), residential area ($P = .9626$), or socioeconomic status ($P = .9982$) between the 2 groups. Therefore, we obtained the control group (non-SD) through appropriate propensity score matching from these statistics.

3.2. Incidence rate and HR for headaches

The incidence rate for headache per 1000 person-years over the 10-year follow-up period was calculated for each category in the SD and non-SD groups and the results are shown in Table 2.

The incidence rates for headache were 24.5 and 33.8 per 1000 person-years in the non-SD and SD groups, respectively. The adjusted HR for the SD group was 1.37 (95% CI: 1.31-1.43), compared to the non-SD group.

The incidence rates for headache were 22.6 and 34.5 per 1000 person-years in the male and female groups, respectively. The adjusted HR for the female group was 1.58 (95% CI: 1.52-1.64), compared to the male group.

The incidence rates for headache were 21.5, 23.9, 29.4 and 34.7 per 1000 person-years in the groups < 20, 20 to 40, 40 to 60, and over 60 years old, respectively. The adjusted HR for the groups 20 to 40, 40 to 60, and over 60 years old were 1.09 (95% CI: 1.02-1.17), 1.39 (95% CI: 1.29-1.49) and 1.67 (95% CI: 1.53-1.81), respectively, compared to the group < 20 years old.

Table 1

Characteristics of the control (non-SD) and study (SD) groups.

Variable	Control (non-SD) group (n = 28243)	Study (SD) (n = 9171) group	Chi squared	*P*- value
Sex				
Male	18582	6018	0.0849	.7708
Female	9661	3153		
Age, yr				
20	2876	937	0.1072	.991
20-40	12724	4116		
40-60	10054	3270		
>60	2589	848		
Residential area				
Metropolitan	8619	2811	0.0763	.9626
Urban	6545	2127		
Rural	13079	4233		
Socioeconomic status				
<30 (low)	2681	869	0.0036	.9982
30-70 (middle)	11977	3888		
>70 (high)	13585	4414		

SD = septal deviation.

Table 2

Incidence per 1000 person-yr and hazard ratios for headache during 10-yr follow-up period.

Variable	Study group Total	Number of cases	Incidence per 1000-person years	HR adjusted	Unadjusted
Group					
Non-SD	28243	7536	24.5	1	1
SD	9171	2973	33.8	1.37 (1.31–1.43)	1.36 (1.30–1.42)
Sex					
Male	24600	5990	22.6	1	1
Female	12814	4519	34.5	1.58 (1.52–1.64)	1.55 (1.49–1.61)
Age, yr					
<20	3813	907	21.5	1	1
20–40	16840	4312	23.9	1.09 (1.02–1.17)	1.10 (1.03–1.18)
40–60	13324	4079	29.4	1.39 (1.29–1.49)	1.37 (1.27–1.47)
60	3437	1211	34.7	1.67 (1.53–1.81)	1.63 (1.50–1.78)
Residential area					
Metropolitan	11430	2948	24.0	1	1
Urban	8672	2560	28.1	1.22 (1.16–1.29)	1.18 (1.12–1.24)
Rural	17312	5001	27.4	1.17 (1.12–1.22)	1.15 (1.10–1.20)
Economic status					
<30 (low)	3550	1085	29.3	1	1
30–70 (middle)	15865	4433	26.4	0.95 (0.86–1.01)	0.90 (0.85–0.97)
>70 (high)	17999	4991	26.1	0.93 (0.87–0.99)	0.90 (0.84–0.96)

HR = hazard ratio, SD = septal deviation.

The incidence rates for headache were 24.0, 28.1 and 27.4 per 1000 person-years in the metropolitan, urban and rural groups, respectively. The adjusted HR for the urban and rural groups were 1.22 (95% CI: 1.16–1.29) and 1.17 (95% CI: 1.12-1.22), respectively, compared to the metropolitan group.

The incidence rates for headache were 29.3, 26.4, and 26.1 per 1000 person-years in the socioeconomic groups < 30th percentile, 30 to 70th percentile, and > 70th percentile, respectively. The adjusted HR for the socioeconomic groups 30 to 70th percentile and > 70th percentile, were 0.95 (95% CI: 0.86-1.01) and 0.93 (95% CI: 0.87-0.99), respectively, compared to the < 30th percentile group.

3.3. Survival curves of patients in SD and non-SD group

The survival curve between SD and non-SD showed a statistically significant difference. (Fig. 1) We used univariate and multivariate cox regression models. The univariate cox regression model is unadjusted HR and the multivariate cox regression model means adjusted HR. The unadjusted HR for headache incidence during the 10-year follow-up period of the SD group was 1.36 (95% CI: 1.30-1.42). After adjusting the socioeconomic factor (age, sex, household income, residential area), the adjusted HR was 1.37 (95% CI: 1.31-1.43).

4. Discussion

The causes of headache are extremely varied: migraine headache, vascular headache, tension headache, drug-induced headache, and so on, and headache sufferers are often referred to otorhinolaryngology clinics for treatment.[9] It has been reported that patients with migraine make 1.7 times more visits to hospital and have 1.8 times more days with sick leave than controls, and are 1.8 times more likely to suffer from depression and anxiety.[10] Chronic headaches reduce the quality of life and make daily life difficult, leading to illness such as depression.[11] We therefore planned a longitudinal cohort study to examine the relationship between headache and SD, which is a relatively common condition. Analysis of data from a cohort of 1 million patients has rarely been reported.

Recently, there has been a report that the prevalence of migraine varies according to age and sex. According to 1 study, 1.2 million children and adolescents had a similar prevalence to young men and women, but more migraine headaches occurred in women in their late teens, and migraine headaches were more common as age increased.[12] Another report found that cluster headaches were more common in men than women, but as age increased, the tendency to develop gradually decreased in men and increased in women.[13] Our study showed that women were 1.58 times more likely to have headaches than men and those in their 60s were 1.67 times more likely to have headaches compared to their late teens, indicating that headaches are more likely to occur with age. This is roughly equivalent to reports in previous studies.

SD is a congenital or acquired condition in which the nasal septum is deflected to 1 side. This causes asymmetry of the left and right nasal airflow and can lead to various symptoms including a contact point headache. In this paper, a population-based study was conducted to confirm this with a large sample. To our knowledge, this is the first large sample cohort study regarding SD and headache. The SD group had a higher headache risk compared to the non-SD group, with an adjusted HR of 1.37 and unadjusted HR of 1.36. Regardless of correction, it seems certain that there will be more headache over time in septal development patients.

The strengths of this study are

(1) a large number of samples: 9171 in the SD group and 28243 in the non-SD group.
(2) We tried to obtain similar power to a randomized controlled trial through propensity score matching even though this cohort study was an observational study.[14]

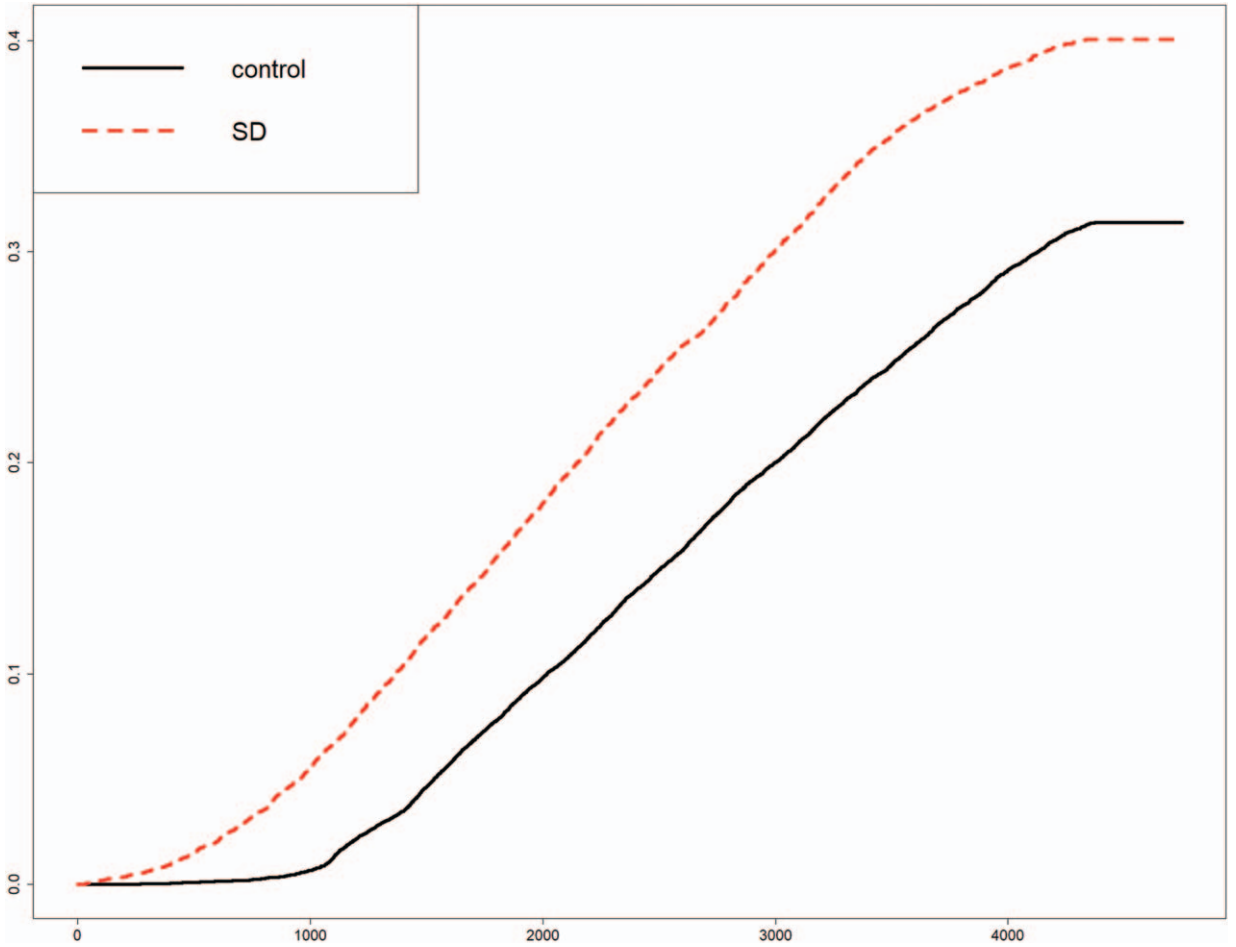

Figure 1. Cumulative hazard ratio curve for headache in SD and control group (SD; septal deviation, control; non-SD group). SD = septal deviation.

(3) The data from the National Health Insurance Corporation covers 1 million individuals and is representative of the 50 million people in Korea, and the reliability of the data is high.[15–25]

The disadvantages of this study are

(1) it was difficult to differentiate the left and right position of the septum in the National Health Insurance Corporation data.
(2) Due to the nature of the data, it was difficult to link this to clinical information such as computed tomography, magnetic resonance image, and so on, so that defining the degree of SD and quantitative analysis of the degree of headache were impossible.

5. Conclusion

This cohort study suggests that SD is associated with headache. Therefore, these findings suggest that septoplasty can be considered as 1 of the treatment option in SD patients with headache.

Author contributions

Writing – review & editing: Sang Jae Noh, Jong Hwan Lee, Ji Seob Yoo, Ji hoon Koh, Byeong Jin Kim.

References

[1] Quinn NA, Alt JA, Ashby S, et al. Time, resident involvement, and supply drive cost variability in septoplasty with turbinate reduction. Otolaryngol Head Neck Surg 2018;159:310–4.
[2] Van Egmond MMHT, Rongen JJ, Hedeman CJT, et al. Septoplasty versus non-surgical management for nasal obstruction due to a deviated nasal septum in adults: a modelling study of cost-effectiveness. Clin Otolaryngol 2019;44:53–62.
[3] Rozen TD. Intranasal contact point headache: missing the "point" on brain MRI. Neurology 2009;72:1107.
[4] La Mantia I, Grillo C, Andaloro C. Rhinogenic contact point headache: surgical treatment versus medical treatment. J Craniofac Surg 2018;29: e228–30.
[5] Low WK, Willatt DJ. Headaches associated with nasal obstruction due to deviated nasal septum. Headache 1995;35:404–6.
[6] Altin F, Haci C, Alimoglu Y, et al. Is septoplasty effective rhinogenic headache in patients with isolated contact point between inferior turbinate and septal spur? Am J Otolaryngol 2019;40:364–7.
[7] Wang J, Yin JS, Peng H. Investigation of diagnosis and surgical treatment of mucosal contact point headache. Ear Nose Throat J 2016;95:E39–44.
[8] Harrison L, Jones NS. Intranasal contact points as a cause of facial pain or headache: a systematic review. Clin Otolaryngol 2013;38:8–22.
[9] Yin JH, Tsai CL, Lee PJ, et al. Age-specific and gender-dependent impact of primary headache disorders on dementia risk: population-based longitudinal study. Medicine (Baltimore) 2018;97:e13789.
[10] Korolainen MA, Kurki S, Lassenius MI, et al. Burden of migraine in Finland: health care resource use, sick-leaves and comorbidities in occupational health care. J Headache Pain 2019;20:13.

[11] Jiang W, Li Z, Wei N, et al. Effectiveness of physical therapy on the suboccipital area of patients with tension-type headache: a meta-analysis of randomized controlled trials. Medicine (Baltimore) 2019;98:e15487.
[12] Albers L, Kries RV, Straube A, et al. Age- and sex-specific first health care use for migraine in 2016 in children and adolescents from prospectively collected health insurance data in Germany. Cephalalgia 2019;39:1156–63.
[13] Manzoni GC, Camarda C, Genovese A, et al. Cluster headache in relation to different age groups. Neurol Sci 2019;40:9–13.
[14] Ming K, Rosenbaum PR. A note on optimal matching with variable controls using the assignment algorithm. J Comput Graph Stat 2001;10: 455–63.
[15] Lee SY, Lim JS, Oh DJ, et al. The association between Bell's palsy and rheumatoid arthritis: a longitudinal study. Medicine (Baltimore) 2020;99:e19568.
[16] Choi HG, Lee MJ, Lee SM. Mortality and causes of death in a population with blindness in Korea: a longitudinal follow-up study using a national sample cohort. Sci Rep 2020;10:4891.
[17] Kim SY, Lee JK, Lim JS, et al. Increased risk of dementia after distal radius, hip, and spine fractures. Medicine (Baltimore) 2020;99:e19048.
[18] Jin YJ, Park B, Park IS, et al. Increased risk of herpes zoster in patients with peptic ulcers: a longitudinal follow-up study using a national sample cohort. Medicine (Baltimore) 2020;99:e19318.
[19] Lee JW, Lee YB, Kwon BC, et al. Mortality and cause of death in distal radius fracture patients: a longitudinal follow-up study using a national sample cohort. Medicine (Baltimore) 2019;98:e18604.
[20] Kim SY, Min C, Oh DJ, et al. Bidirectional association between GERD and asthma: two longitudinal follow-up studies using a national sample cohort. J Allergy Clin Immunol Pract 2020;8:1005–13.
[21] Choi HG, Kim EJ, Lee YK, et al. The risk of herpes zoster virus infection in patients with depression: a longitudinal follow-up study using a national sample cohort. Medicine (Baltimore) 2019;98: e17430.
[22] Choi HG, Oh DJ, Kim M, et al. Appendectomy and rheumatoid arthritis: a longitudinal follow-up study using a national sample cohort. Medicine (Baltimore) 2019;98:e17153.
[23] Kim SY, Oh DJ, Park B, et al. Increased risk of appendectomy in patients with asthma: a nested case-control study using a national sample cohort. Medicine (Baltimore) 2019;98:e17203.
[24] Kim SY, Lee JK, Oh DJ, et al. Depression and incident hip fracture: a longitudinal follow-up study using a national sample cohort. Medicine (Baltimore) 2019;98:e16268.
[25] Kim SY, Kim HJ, Lim H, et al. Association between cholelithiasis and sialolithiasis: two longitudinal follow-up studies. Medicine (Baltimore) 2019;98:e16153.