

Clinical Communications

Septal deviation could be associated with the development of bronchial asthma: A nationwide cohort study

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Clinical Implications

In this nationwide observational study, the incidence of asthma was higher in the septal deviation group compared with the matched controls. Moreover, septoplasty was associated with a lower incidence of asthma, suggesting that septal deviation is one of the treatable traits in patients with asthma.

Septal deviation (SD) is a common anatomic abnormality. In nasal breathing, respiratory airflow is divided by the nasal septum, and in the case of SD, airflow in either nostril can be impaired, resulting in nasal obstruction and increased nasal resistance. Severe cases of nasal obstruction due to SD can lead to snoring and sleep apnea.¹ In addition, severe SD affects the physiology of the nasal cavity and causes mucosal and neurological changes;² however, information is scarce regarding the impact of SD on lower respiratory tract pathophysiology.

Asthma, one of the most common chronic inflammatory diseases of the lower respiratory tract, is a heterogeneous clinical syndrome caused by a complex interaction between genetic and environmental factors. Although numerous factors including atopy, allergen, air pollution, and respiratory tract infection are known to provoke or exacerbate asthmatic inflammation, the exact pathophysiology of asthma is largely unknown. In particular, it is not known whether specific pathologic conditions of the upper respiratory tract can influence asthmatic symptoms and inflammation; however, potential causal relationships between them have been suggested. For example, it has been reported that allergic inflammation in allergic rhinitis (AR) is closely linked to asthmatic symptoms.³ Based on these findings, it is likely that there are potential mechanistic links between upper and lower respiratory tract disorders, and many researchers have suggested a potential link. Nonetheless, there is limited information regarding the association between SD and asthma.

Herein, we investigated the potential impact of SD on the incidence of asthma. Furthermore, we examined whether surgical correction of SD (septoplasty) affects the incidence of asthma in SD.

The National Health Insurance Service — National Sample Cohort (NHIS-NSC) database is anonymized and contains data on approximately 1 million people, representing approximately 2% of all Koreans (NHIS-2021-1-689). Of this representative retrospective cohort, the presence of SD was indicated by diagnostic code J342 (based on the International Classification of Diseases, 10th Revision [ICD-10] diagnosis codes) in patients diagnosed between 2002 and 2004. The presence of target

disease asthma was indicated by ICD code J45. The control (non-SD) group was calculated by 1:2 propensity score (PS) matching considering age, sex, residential area, economic status, history of hypertension (HTN), and history of diabetes mellitus (DM). The adjusted hazard ratio (aHR) in the Cox proportional-hazards model was calculated by considering all other variables, and the unadjusted HR was obtained without considering other variables. In subgroup analysis of the SD group, we examined sex, economic status, age, residential area, underlying diseases, and presence or absence of septoplasty. Confirmation whether PS matching was successful was shown by the standardized mean differences (SMDs) in each group.

Of the 1 million cohort samples, a total of 29,853 individuals (9,951 in the SD group and 19,902 in the non-SD group) were followed up for a total of 9 years from January 2005 to December 2013. There were no significant imbalances between the SD and non-SD groups (all SMDs < 0.1). [Figure 1](#) shows that the aHR for asthma in the SD group was 2.43 (95% confidence interval [CI], 2.31-2.56), that is, the incidence of asthma was 2.43 times higher in the SD group compared with the control group. The 9,951 patients diagnosed with SD between 2002 and 2004 were divided into 2 subgroups with 1,526 patients in the subgroup who received septoplasty and 8,425 patients in the subgroup who did not receive septoplasty. As a result of follow-up until 2013, in the SD group, the aHR for asthma after septoplasty was 0.83 (95% CI: 0.75-0.93), and the cumulative incidence rates for those with septoplasty and those with no septoplasty are shown in [Figure 1](#). The results in [Figure 1](#) suggest that SD plays a potential role in the development of asthma and that septoplasty in patients with SD may lower the incidence of asthma in some patients.

In subgroup analysis of the SD group, the aHR of AR was 1.58 (95% CI: 1.50-1.67), the aHR of chronic rhinosinusitis (CRS) was 1.22 (95% CI: 1.15-1.31), the aHR of male patients was 0.70 (95% CI: 0.67-0.74), the aHR of young people was 0.64 (95% CI: 0.61-0.68), and the aHR of the HTN group was 1.13 (95% CI: 1.01-1.27). However, there were no significant aHRs of high economic status, residential area, and DM ([Figure 2](#); [Figure E1](#), available in this article's Online Repository at www.jaci-inpractice.org).

Classically, the upper and lower respiratory tracts share many anatomic and histological features, and are united to form one airway through which air passes into and out of the lungs.⁴ It is well known that AR, CRS, and asthma are associated with each other;⁵ however, there is insufficient information on the effects of SD on lower airway disease. In the pathobiological context, when airflow dynamics are altered in patients with SD, histological changes such as squamous metaplasia and infiltration of inflammatory cells can be observed in the nasal mucosa.⁵ These changes can affect mucociliary clearance and production of mucus through the airways,⁵ which may lead to a chronic inflammatory condition in the airways typically observed in asthma. Furthermore, a potential association between SD and dysfunctional breathing, commonly observed in 20% to 30% of asthma cases and more in difficult-to-treat asthma (up to 50% cases), may impact its diagnosis and/or make asthma more difficult to treat.^{6,7} In fact, dysfunctional breathing is defined by

Cumulative Hazard Plot of SD and Septoplasty for Asthma

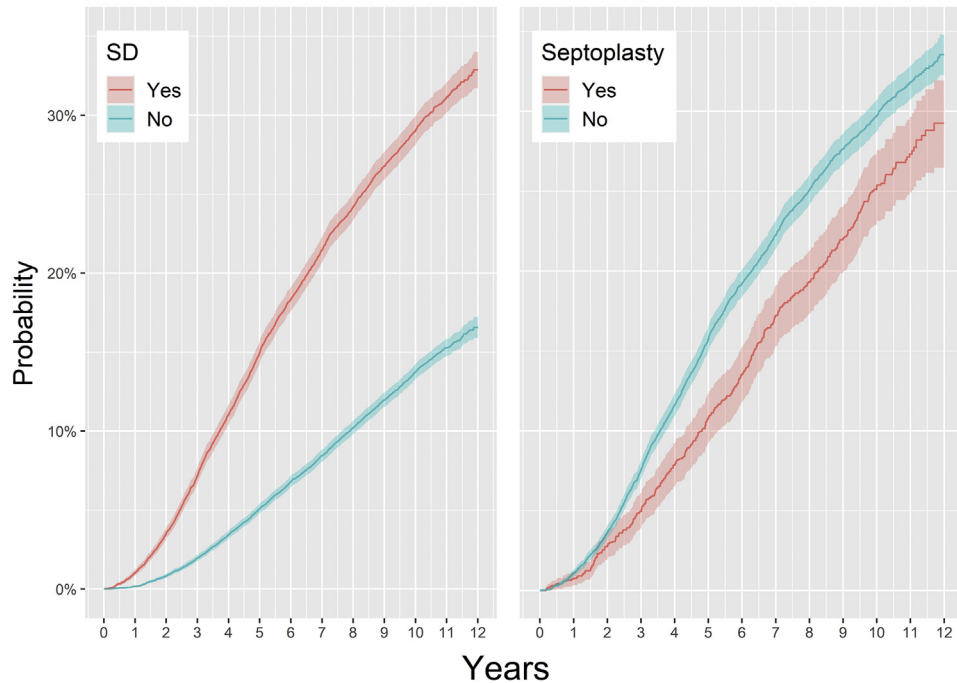


FIGURE 1. Left panel: overall cumulative hazard ratios for asthma in the SD group and the control (non-SD) group. Right panel: cumulative incidence rates for asthma in those with septoplasty and those with no septoplasty. *SD*, Septal deviation.

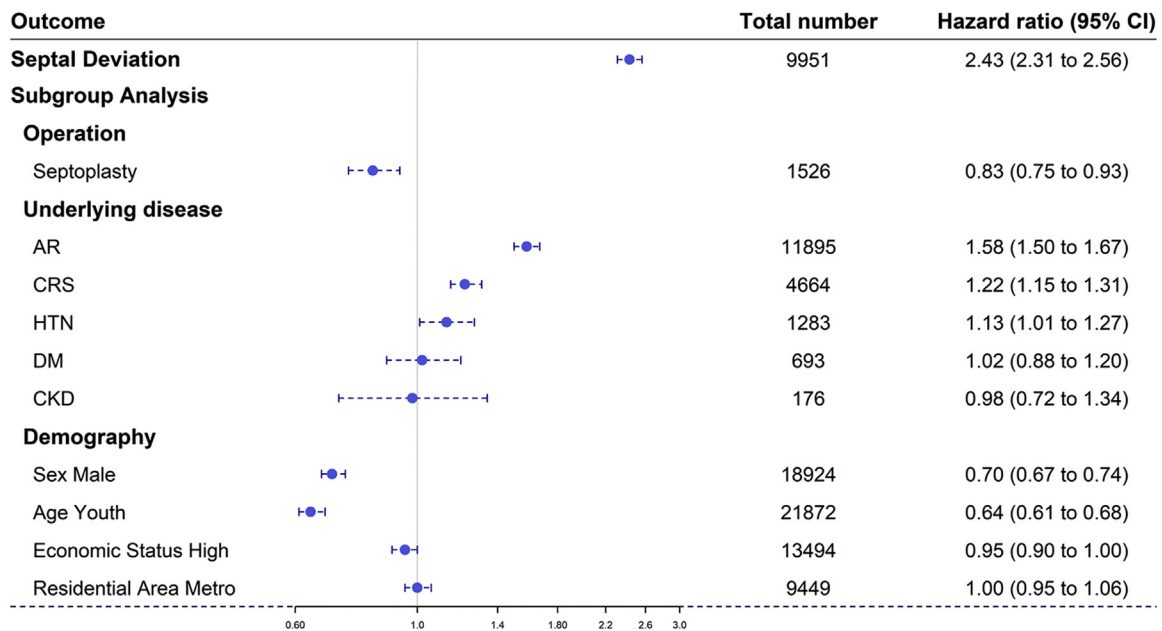


FIGURE 2. Forest plot of the cumulative hazard ratio for each factor: septal deviation, sex, economic status, age, residential area, underlying disease (AR, CRS, HTN, DM, CKD), and septoplasty. *AR*, Allergic rhinitis; *CI*, confidence interval; *CKD*, chronic kidney disease; *CRS*, chronic rhinosinusitis; *DM*, diabetes mellitus; *HTN*, hypertension; *Metro*, metropolitan.

the Nijmegen Questionnaire, which distinguishes hyperventilation syndrome from healthy controls.⁶ Considering that SD is a representative disease closely associated with nasal congestion as seen in obstructive sleep apnea (OSA) in the upper airways⁸ and hyperventilation syndrome,⁹ it is worth noting that the lower

incidence of asthma after septoplasty could be due to the elimination of this dysfunctional breathing and not the asthma itself. In this context, previously, we found that surgical correction of SD is associated with a decreased incidence of OSA.⁸ We speculate that all of these effects may influence the incidence of

asthma and the effects of treatment of septoplasty on asthma in patients with SD; however, further studies are necessary to clarify the association between them.

In this study, through analysis of the NHIS-NSC database, it was confirmed that SD, with consequent structural alteration of the upper airway, has an effect on the development of asthma. In addition, subgroup analysis confirmed that, in individuals with SD, the incidence of asthma decreased with younger age and male sex and increased with HTN. Interestingly, in this paper, septoplasty was associated with a reduced incidence of asthma, which provides evidence for surgical correction to control the development of this condition in patients with SD. Further research is necessary to elucidate the relationship between SD and asthma, and intervention studies will be required to confirm a relationship between septoplasty and subsequent asthma development.

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Y. S. You conceived and designed the study, collected the data, performed the analysis and wrote the manuscript. J. S. Kim conceived and designed the study, collected the data, performed the analysis and revised the manuscript. J. S. Jeong conceived and designed the study, interpreted the data, and wrote the manuscript. S. W. Yeom collected the data and performed the analysis. D. H. Kim edited and revised the manuscript. S. H. Kwon edited and revised the manuscript. Y. C. Lee conceived and designed the study, interpreted the data, and edited the manuscript.

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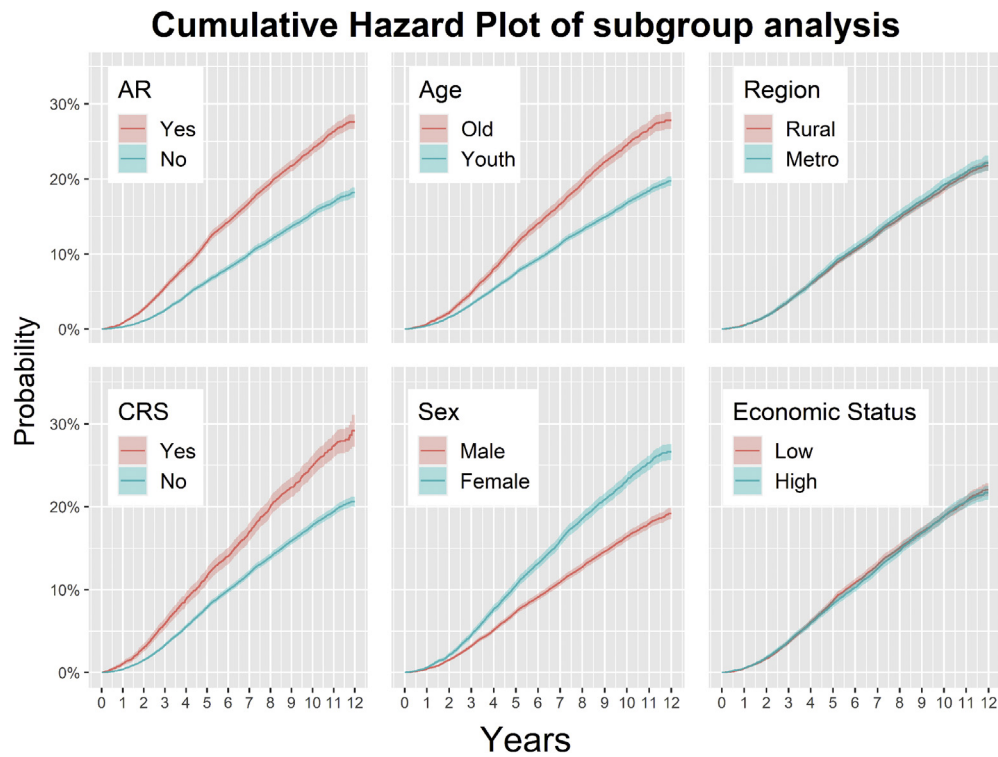


FIGURE E1. Cumulative hazard plot of subgroup analysis (AR, CRS, age, sex, residential area, economic status). *AR*, Allergic rhinitis; *CRS*, chronic rhinosinusitis; *Metro*, metropolitan.