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# Evaluation of the nasal septal body in pediatric patients

Kübra Çoban, Fulya Özer, M. Volkan Akdoğan

Department of Otorhinolaryngology, Başkent University School of Medicine, Ankara, Turkey

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**ABSTRACT**

**Objective:** The nasal septal body (NSB) is a fusiform shaped dynamic structure and the widest part of the anterior septum. It consists of a thickened septal cartilage, bone, glandular, and vasoactive structures covered by mucous membranes. Hence, it plays a role in nasal airflow and humidification. This study evaluated the size of this structure in pediatric patients with allergic rhinitis and other sinonasal pathologies.

**Methods:** The study was conducted at the Başkent University Hospital otolaryngology department between 2015 and 2019. A total of 117 children were enrolled, including 96 patients and 21 controls. The study group was divided into 3 sub-groups: group 1, with sinonasal pathologies and allergic rhinitis; group 2, with sinonasal pathologies only; and group 3, with allergic rhinitis only. The widest horizontal part of the NSB was measured on paranasal coronal computed tomography sections.

**Results:** The mean NSB width in the patient and control groups were 1.00±0.19 cm and 0.90±0.16 cm, respectively. The NSB was significantly larger in the patient groups compared to the controls (p=0.032). There was no significant difference among the study sub-groups in terms of NSB width (p=0.215). A significant positive correlation was found between age and NSB in the patient and control groups (r=0.366, p=0.000 and r=0.632, p=0.002, respectively). There was a significant correlation between age and NSB in group 1 and group 2 (r=0.354, p=0.015 and r=0.447, p=0.010, respectively).

**Conclusion:** The nasal septal body is significantly larger in children with comorbid sinonasal pathologies and allergic rhinitis compared to the control group.

**Keywords:** Allergic rhinitis, nasal septal body, nasal turbinate, pediatric rhinosinusitis, sinusitis

## Introduction

The nasal septal body (NSB) is a dynamic structure, similar to the inferior nasal turbinate (IT), which plays a role in nasal airflow and air humidification (1). It is located superior to the IT and anterior to the middle nasal turbinate. The NSB is thought to have a significant effect on nasal valve airflow owing to its location and structure, which includes vasoactive secretory glands (2).

Gelera et al. (3) have reported significantly larger NSB in patients with a history of sinonasal pathologies. Setlur et al. (4) have showed significantly enlarged NSB tissue opposite the septal deviation site. Wong et al. (5) have suggested that NSB can be decongested with topical decongestants. Moss et al. (6) have recommended a reconsideration of our knowledge on evaluating patients with nasal obstructions and have suggested that NSB be considered as well (3).

Nasal obstruction in the pediatric population is commonly attributed to adenoid hypertrophy, septal deviation, IT hypertrophy, nasal polyposis, and nasal tumors. Laminar flow can be interrupted in various areas of the nasal cavity because of the aforementioned pathologies (7).

The NSB is one of the structures located in the laminar flow zone (7). Sullivan et al. (8) have evaluated children with an enlarged IT who underwent adenotonsillectomy and found significantly increased postoperative relief in the patient group that underwent concomitant IT intervention. Hizli et al. (9) have reported that the NSB was significantly larger in patients with inferior turbinate hypertrophy. Although the NSB can easily be observed and managed via anterior rhinoscopy or endoscopic methods, our knowledge of the NSB in children is inadequate.

Increasing knowledge about the anatomy and physiology of the airway in children is of great importance for effective approaches to pathological conditions. In this study, we aimed to compare the width of the NSB in healthy children and patients with sinonasal (allergic or non-allergic) pathologies. Physiological responses in pediatric patients may differ from those in adults. Therefore, an evaluation of the NSB and knowing its response to various pathologies will make it possible to increase the success of treatment with minimally invasive interventions to this region.

Corresponding Author: Kübra Çoban, kubracob81@gmail.com
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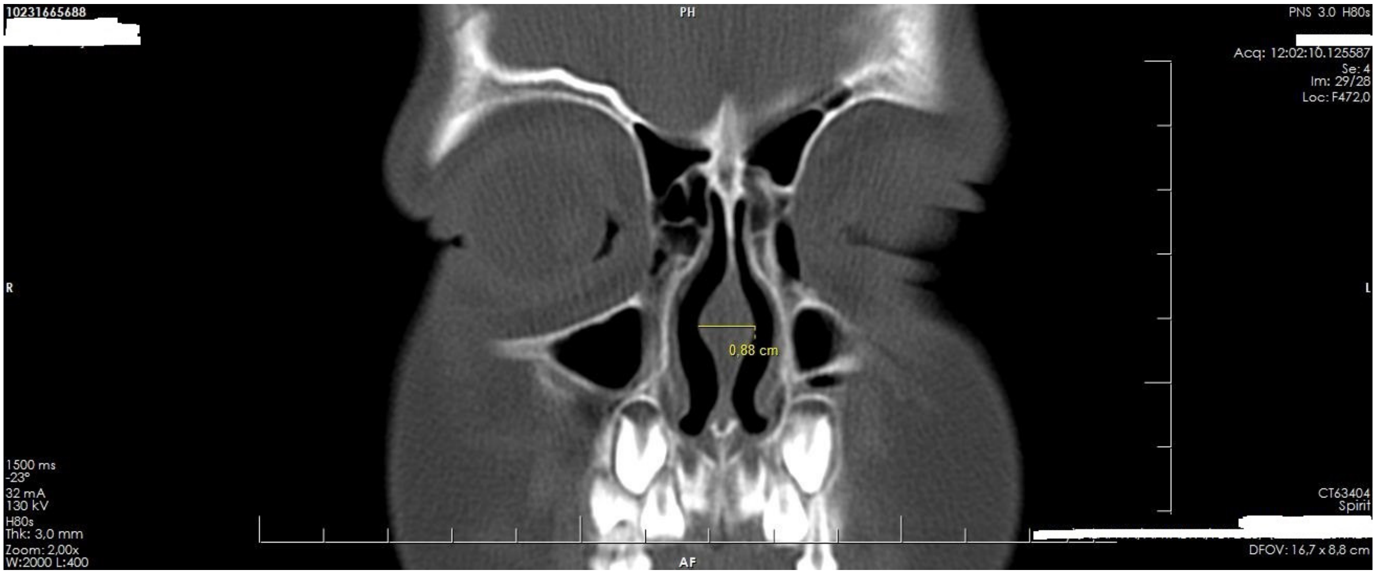


**Figure 1.** Measuring the widest horizontal part of the nasal septal body on paranasal computed tomography coronal sections

## Methods

The study was conducted at the Başkent University Hospital otolaryngology department between 2015 and 2019 in patients under 16 years of age. All procedures performed in studies involving human participants were per the ethical standards of the institutional and/or national research committe Başkent University institutional review board and ethics committee project no: KA20/15) and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

A total of 117 children were enrolled including 96 patients and 21 controls. The control group consisted of patients with no symptoms or signs of allergies (negative skin prick test and normal serum levels of IgE), sinonasal diseases, having no systemic or local medical therapies, whose paranasal computed tomography (CT) scans were performed by experts in other departments (e.g., neurology, pediatrics, and neurosurgery) for issues such as headaches and preoperative evaluations. The patient group consisted of children with various sinonasal pathologies (nasal septal deviation, acute sinusitis, chronic rhinosinusitis with or without nasal polyposis, antrochoanal polyps) and allergic complaints. The study group was divided into 3 sub-groups: group 1 consisted of those with sinonasal pathologies and allergic rhinitis; group 2 of those with sinonasal pathologies only; and group 3 of those with allergic rhinitis only.

**Main Points:**

- The nasal septal body (NSB), located in the nasal valve area, is a dynamic structure that can expand.
- It is of great importance for nasal air flow owing to this ability to expand.
- Knowledge about the dimensions of NSB and its effects on sinonasal pathologies in pediatric patients is insufficient as studies are usually conducted in adults.
- The mean width of NSB was significantly higher in patient groups compared to the control group.
- A complete nasal examination is required in children with nasal obstruction; the width of the NSB may increase sinonasal complaints.

### Exclusion Criteria

Patients who have received treatments for various sinonasal complaints in the last 6 months.

Patients with a history of sinonasal surgery

Patients with a comorbid systemic disease or infection

Patients for whom paranasal CT scans were not performed at their initial outpatient attendance for their complaints

Patients with paranasal CT images not suitable for NSB measurements

Informed consent was obtained from the patients who participated in this clinical investigation.

Paranasal CTs were evaluated by a senior otorhinolaryngologist who was blinded to the study. The widest horizontal part of the NSB was measured on coronal CT sections as shown in Figure 1.

In our clinic, a skin prick test was performed with standardized allergen extracts (Allergopharma D-21462 Reinbek, Germany) with the technique standardized by the European Academy of Allergy and Clinical Immunology (10). The diagnosis of allergic rhinitis was made clinically according to the allergic rhinitis and its impact on asthma guidelines (11). Acute and chronic sinusitis diagnoses were made according to the American Academy of Otolaryngology - Head and Neck Surgery Adult Sinusitis guidelines and the Lund–Mackay score (12, 13).

### Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences, version 17.0 software (SPSS Inc.; Chicago,IL, USA). The suitability of variables to normal distribution was examined using a histogram and Kolmogorov–Smirnov tests. The mean, standard deviation, and median (min/max) values were used to conduct analyses of descriptive statistics. Variables of the 2 groups that were not normally distributed (non-parametric) were evaluated using the Mann–Whitney U test. The Kruskal–Wallis test was used to evaluate more than 2 groups. Spearman's correlation test was used to analyze the data against each other. Results with a p value below.05 were considered statistically significant.

## Results

Age and sex distributions are shown in Tables 1 and 2; there was no significant difference among the groups in terms of these variables. The distribution of sinonasal pathologies among groups is listed in Table 3.

**Table 1. Age distribution among groups**

| | Age | | |
|---|---|---|---|
| Groups | Mean | SD | p |
| *Study | 11.42 | ±4.16 | 0.716 |
| Control | 11.05 | ±4.41 | |
| **Group 1 | 10.97 | ±4.14 | 0.180 |
| Group 2 | 12.19 | ±4.07 | |
| Group 3 | 10.12 | ±4.27 | |

*Mann–Whitney U Test
**Kruskal–Wallis test
SD: Standard deviation

The mean width of the NSB in the patient and control groups were 1.00±0.19 cm and 0.90±0.16 cm, respectively. The NSB was significantly larger in the patient group than in the control group (p=0.032). However, there were no significant differences among the study sub-groups in terms of NSB width (p=0.215).

There was no significant difference in the width of the NSB in terms of sex when the study sub-groups were compared with each other or to the controls (p>0.05).

A significant positive correlation was found between age and the width of the NSB in the patient and control groups (r=0.366, p=0.000 and r=0.632, p=0.002, respectively). In addition, there was a significant correlation between age and NSB in groups 1 and 2 (r=0.354, p=0.015 and r=0.447, p=0.010, respectively).

## Discussion

The findings of our study showed that the mean width of NSB was significantly higher in our patient groups compared to the control group. In the literature, NSB widths of approximately 10–12 mm (3, 4, 14) were reported; however, these data were from adult patients. To the best of our knowledge, reference

**Table 2. Sex distribution among groups**

| | | | | Patient | | Control | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | n | % | n | % | N | % | p |
| Sex | Male | | | 50 | (52.08) | 11 | (52.38) | 61 | (52.14) | 0.980 |
| | Female | | | 46 | (47.92) | 10 | (47.62) | 56 | (47.86) | |
| | | Group 1 | | Group 2 | | Group 3 | | Total | | |
| | | n | % | n | % | N | % | n | % | p |
| Sex | Male | 19 | (59.38) | 20 | (42.55) | 11 | (64.71) | 50 | (52.08) | .176 |
| | Female | 13 | (40.63) | 27 | (57.45) | 6 | (35.29) | 46 | (47.92) | |

Pearson's Chi-squared test

**Table 3. Sinonasal pathologies in each sub-group**

| | | Group 1 | | Group 2 | | Group 3 | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | p |
| Septal deviation | absent | 15 | (46.88) | 19 | (40.43) | 17 | (100) | 51 | (53.13) | <0.001 |
| | present | 17 | (53.13) | 28 | (59.57) | 0 | (0) | 45 | (46.88) | |
| Acute sinusitis | absent | 25 | (78.13) | 40 | (85.11) | 17 | (100) | 82 | (85.42) | 0.118 |
| | present | 7 | (21.88) | 7 | (14.89) | 0 | (0) | 14 | (14.58) | |
| Chronic sinusitis | absent | 19 | (59.38) | 29 | (61.70) | 17 | (100) | 65 | (67.71) | 0.007 |
| | present | 13 | (40.63) | 18 | (38.30) | 0 | (0) | 31 | (32.29) | |
| Nasal polyposis | absent | 29 | (90.63) | 45 | (95.74) | | | 74 | (93.67) | 0.359 |
| | present | 3 | (9.38) | 2 | (4.26) | | | 5 | (6.33) | |
| Antrochoanal polyp | absent | 29 | (90.63 | 46 | (97.87) | | | 75 | (94.94) | 0.149 |
| | present | 3 | (9.38) | 1 | (2.13) | | | 4 | (5.06) | |

Pearson's Chi-squared test

data for the dimensions of the NSB in pediatric patients were not available in the literature. According to the studies available, the NSB can grow according to pathological conditions owing to its dynamic glandular structure (3, 4, 14, 15). The NSB was found to be larger in patients with septum deviations, allergic rhinitis, sinusitis, and nasal polyps compared to healthy individuals (3, 4, 9, 14, 15). In this study of pediatric patients, the results seem to be consistent with the literature; however, the pathologies that have a pronounced effect on this structure have not yet been clarified. Therefore, we evaluated patients with sinonasal pathologies and allergic rhinitis separately. Our results showed that the mean widths of the NSB were not significantly different among the sub-groups in our study. Furthermore, although we expected that NSB would be larger in the sinonasal + allergic rhinitis group compared to the others because of a "double effect," the results were statistically insignificant.

We suggest that NSB is an effective compensatory mechanism within the nose but its capacity to expand is limited. Sinusoidal structures are mostly present in the IT in the nasal cavity; therefore, the NSB may not expand as much as the IT. However, as the NSB is located in the nasal valve region, even small changes in its size can cause significant nasal congestion.[16] The presence of multiple coexisting nasal pathologies does not seem to cause any additive changes in the width of the NSB.

Some studies support the suggestion that the NSB decreases in size with age (17, 18). They attribute this to the atrophy of this structure over time. Our study found a significant positive correlation between width of the NSB and age. Arslan et al. (17) have also reported that the NSB is more common between the ages of 8 and 20. We suggest that this structure may, in pediatric patients, increase in size with age owing to the effect of metabolic and hormonal factors. Although a positive correlation was found between age and NSB in groups 1 and 2, no such result was obtained in group 3. However, the reason for this difference could be the difference in the number of patients in the groups. Therefore, studies with a wide patient series are needed.

Arslan et al. (17) also suggested that the nasal septal body (NSB)itself is more frequently observed in adult men; San et al. (18) also reported an increased NSB area in adult men. However, there was no significant difference in the width of the NSB between the sexes in our patient and control groups. We believe that the wide range of ages in our study groups prevented an efficient evaluation of the effects of sex on the size of the NSB.

Some studies have suggested that this structure is a variation (17, 19). Koo et al. (19) reported the incidence of NSB as 25.1%. We infer that this structure exists in every individual and therefore, it is important to evaluate the NSB in patients with nasal congestion.

This evaluation can be achieved via computer tomography or magnetic resonance imaging. As it is a dynamic structure, evaluation with a static method causes some limitations. However, this region contains a thickened septal cartilage and bone and is often confused with a high septal deviation. Therefore, studies support radiographic examination of this structure.[19, 20]

To our knowledge, our study is the first on this topic conducted in a pediatric population. However, there were some limitations to our study. Firstly, further studies with larger patient series and prospective designs are needed. Also, studies evaluating the dimensions of the NSB using both endoscopic and radiological methods are required.

In pediatric patients, the NSB seems to be significantly larger in patients with sinonasal pathologies and allergic rhinitis than in the control groups. As a future goal, the size of the NSB in children with adenoid vegetation, effects of medical and surgical treatments on the dimensions of the NSB, the relationship between NSB dimensions and disease severity, and its effects on nasal symptom scores may be investigated. We hope that this study will inspire further studies on this topic.

**Ethics Committee Approval:** This study was approved by Ethics committee of Başkent University, (Approval No: KA20/15).

**Informed Consent:** Written informed consent was obtained from the patients who agreed to take part in the study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Supervision – M.V.A., F.Ö.; Design – K.Ç, M.V.A, F.Ö.; Concept – M.V.A, F.Ö.; Resources – K.Ç., M.V.A; Materials – K.Ç, M.V.A.; Data Collection and/or Processing – K.Ç., M.V.A.; Analysis and/or Interpretation – K.Ç., M.V.A., F.Ö.; Literature Search – K.Ç., M.V.A.; Writing Manuscript – K.Ç., M.V.A.; Critical Review – M.V.A, F.Ö.

**Conflict of Interest:** The authors have no conflict of interest to declare.

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