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Histological Evaluation of the Nasal Swell Body in Allergic Patients

Alerjik Rinitli Hastalarda Nazal Septal Cismin Histolojisi

Original Investigation
Özgün Araştırmalar

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Abstract

Objective: To evaluate the histopathology of the nasal swell body (NSB) mucosa in allergic patients in comparison with non-allergic patients.

Methods: Our study evaluated 25 allergic and 25 non-allergic patients who underwent septoplasty and bilateral inferior turbinate reduction. The NSB was evaluated via tomographic images and histopathologically. The thickness of the NSB and the glandular structures, arterial structures, capillary and venous sinusoids was measured in both groups. The data were then summarized as the relative proportion of each tissue type, given in percentage form.

Results: The histopathological examination of the nasal mucosa revealed glandular and vascular structures in the NSB, inferior turbinate and septal mucosa. Although the NSB mucosa was thicker in allergic patients than in non-allergic patients, the incidence of glandular cells was increased primarily at the NSB in both allergic and non-allergic patients. There were no significant differences between the allergic and non-allergic groups (p>0.05). Venous sinusoids were more common in the inferior turbinate than in the NSB. There was no difference in the predominance of venous sinusoids between allergic and non-allergic patients.

Conclusion: The NSB is thicker in allergic patients than in non-allergic patients. However, the NSB is rich in glandular cells in both allergic and non-allergic patients. Therefore, any changes in this region may lead to changes in humidification, dysfunction and nasal obstruction.

Key Words: Allergic rhinitis, nasal swell body, septal deviation, histopathological examination, glandular cell

Özet

Amaç: Alerjik rinitli hastalarda nazal septal cisimciğinin (NSC) histopatolojik değerlendirilmesi.

Yöntemler: Septoplasti ve bilateral alt konka redüksiyonu yapılan 25 alerjik rinitli ve 25 alerjik riniti olmayan toplam 50 hasta çalışmaya dahil edildi. NSC bilgisayarlı tomografi ve histopatolojik olarak değerlendirildi. NSC'nin kalınlığı, glandüler yapılar, arteryal yapılar, kapiller ve venöz sinüzoidler her iki grupta hesaplandı.

Bulgular: NSC alerjik hastalarda non-alerjik hastalara göre daha kalın olmasına rağmen, her iki grupta da glandüler hücre yoğunluğu daha fazlaydı. Her iki grup arasında anlamlı bir fark yoktu (p>0.05). Venöz sinüzoidler alt konkada NSC ye göre daha yoğundu, fakat alerjik ve non-alerjik gruplar arasında fark yoktu.

Sonuç: NSC alerjik hastalarda daha kalındır. NSC glandüler hücre açısından hem alerjik, hem de non-alerjik hastalarda daha zengindir. Bu yüzden NSC deki herhangi bir değişiklik nemlendirmede bozulma ve burun tıkanıklığına neden olabilir.

Anahtar Kelimeler: Alerjik rinit, nazal septal cisim, septal deviasyon, histopatholojik muayene, glandüler hücre

Introduction

The nasal swell body (NSB), also called the nasal septal swell body or septal turbinate, is the thickest and widest region of the nasal septum. The NSB is located at the level of the internal nasal valve, and the anteriosuperior portion of the nasal septum is composed of cartilage, bone and its overlying mucoperichondrium (1). The presence and importance of the NSB has not been studied clinically and its function is not clear. High nasal septal deviations may even be misdiagnosed due to hypertrophy of this region. The NSB may experience nasal obstruction even following minimal changes in mucosal thickness. Computed tomography (CT) and magnetic resonance imaging (MRI) evaluation of the NSB showed vasoactive expansile properties but not as much as in the inferior turbinate (2, 3). Histological evaluation of the NSB revealed the presence of seromucinous glands, venous sinusoids and vascular structures (1).

It is well known that the nasal mucosa becomes thicker and oedematous in allergic conditions. Increased nasal secretion and nasal obstruction are common changes in the mucosa in allergic patients (4, 5); however, no studies have evaluated the NSB. Such studies would promote the understanding of nasal physiology and the nasal valve region in allergic patients. In this study, we evaluated the NSB mucosa hi-

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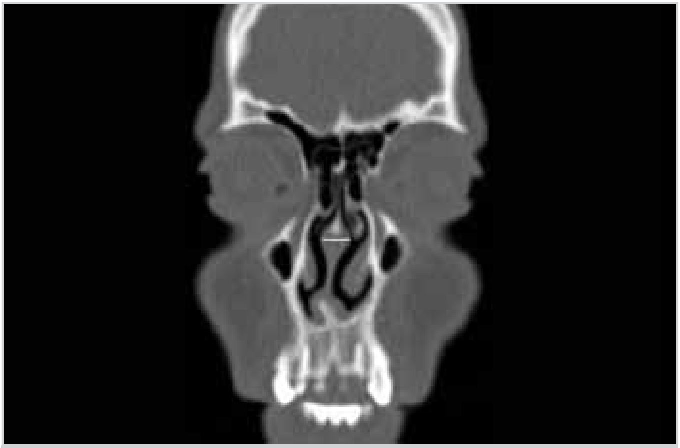

Figure 1. Computed tomography image of nasal septal concha Computed tomography image of nasal septal concha

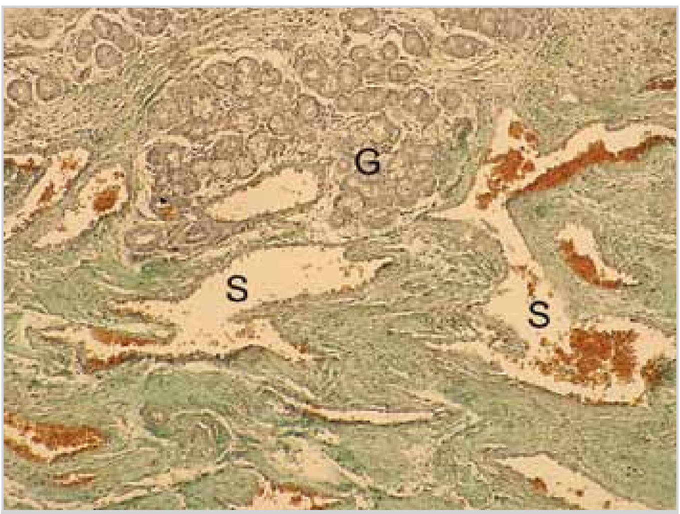

Figure 3. Predominance of glandular structures in the nasal septal concha (G: glandular structures; S: venous sinusoids)

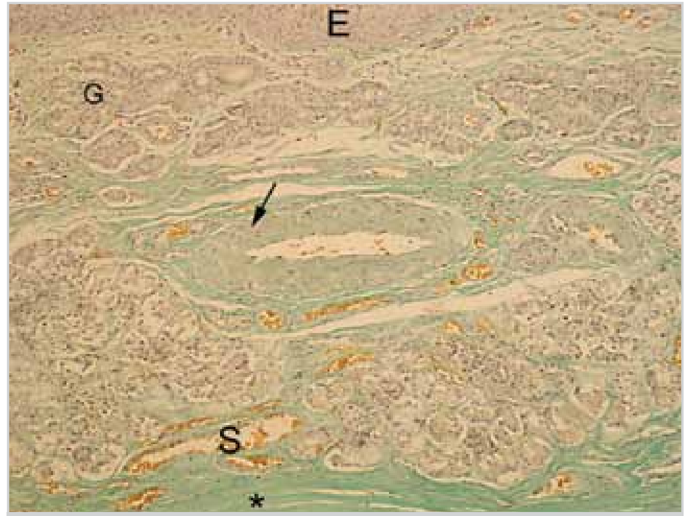

Figure 2. Histological structures of nasal cavity (G: glandular structures; S: venous sinusoids; E: epithelial structures)

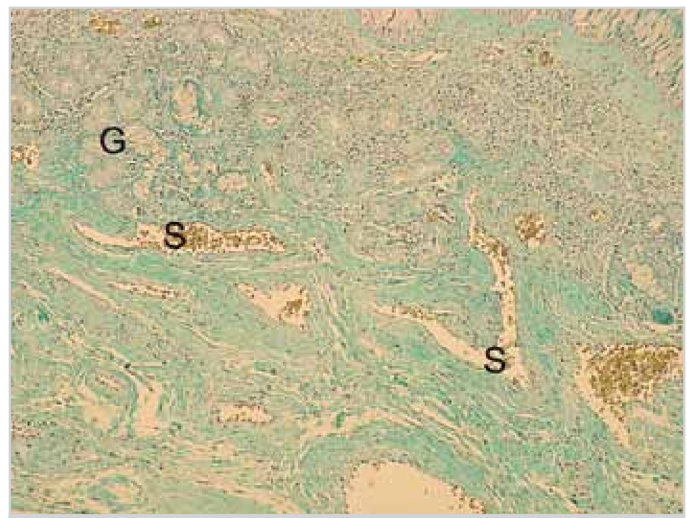

Figure 4. Predominance of venous sinusoids in the inferior turbinate (G: glandular structures; S: venous sinusoids)

stologically in allergic patients. We compared biopsies from the NSB, adjacent inferior turbinate and ipsilateral inferior anterior septum in both allergic and non-allergic patients.

Methods

Ethical approval was obtained from Istanbul Education and Research Hospital local ethical committee, and informed consent was obtained from all patients preoperatively. Our study consisted of 50 patients (25 with allergic rhinitis, 25 without allergic rhinitis) who underwent septoplasty and bilateral inferior turbinate reduction. The diagnosis of allergic rhinitis was made using a skin prick test, with patients testing positive to at least one allergen being classified as having allergic rhinitis. CT scans were obtained before surgery to evaluate paranasal sinuses and were used to determine the thickness and location of the NSB in the coronal section of the sinuses. The widest portion of the nasal septum was accepted as the NSB and its vertical and horizontal diameters were measured (Figure 1). Patients who had acute sinusitis, nasal polyposis, a history of any nasal surgery, a history of topical nasal spray treatment in the past month, and a history of drug abuse or exposure to irritants were excluded from the study. Under general anaesthesia but before local infiltration anaesthesia, 3- to 4-mm-wide full-thickness mucosal biopsies were obtained from one side of the NSB region, the anterior portion of the inferior turbinate and the anterior septum. The specimens were placed immediately in formalin solution and sent for routine tissue processing. After embedding in paraffin and serial sectioning at 5-μm intervals, specimens were stained routinely with haematoxylin-eosin and Masson's-trichome dye. Photomicrographs were prepared at 40× magnification for morphometric analysis; additional selected photos at 100× and 200× magnification were also obtained for illustrative and qualitative review purposes. The glandular structures, arterial structures, capillary and venous sinusoids were measured (Figure 2). The data were then summarized as the relative proportion of each tissue type, given in percentage form. The epithelium was not included in the area proportion analysis because epithelial preservation on the sectioned specimens was variable, and determination of the relative amount of epithelium in comparison to the subepithelial tissue elements was not an objective of this study.

Table 1. Results of the histopathological analysis

	Nasal septal concha			Inferior turbinate			Anterior septal mucosa		
	Group A (%)	Group B (%)	p	Group A (%)	Group B (%)	p	Group A (%)	Group B (%)	p
Glandular structures	43.90	44.45	0.280	28.22	26.91	0.312	1.28	1.40	0.116
Venous sinusoids	11.22	13.11	0.212	26.75	28.3	0.090	9.3	9.2	0.400
Arteriole/capillary structures	0.52	0.40	0.212	0.72	0.68	0.312	0.43	0.51	0.114

Group A: patients with allergic rhinitis
Group B: patients without allergic rhinitis

Statistical analysis
Statistical analysis was conducted using SPSS 16.0 software (SPSS Inc., Chicago, IL). Data were analysed by one-way analysis of variance (ANOVA), with post-hoc testing accomplished by paired t tests with Tukey test for multiple comparisons. The independent-sample t test was used to compare differences in numerical variables between allergic and non-allergic groups.

Results

Both groups consisted of 25 patients: 12 women and 13 men in the allergic group (median age 28±2.3 years, range 18-45 years), and 11 women and 14 men in the non-allergic group (median age 26±1.7 years, range 22-42 years). CT scans showed that the NSB region was thicker in allergic patients than in non-allergic patients: the mean thickness was 6.8±3.4 mm and 4.8±2.3 mm, respectively ($p<0.05$).

The histopathological examination of the nasal mucosa revealed glandular and vascular structures in the NSB, inferior turbinate and septal mucosa (Table 1). The incidence of glandular cells in allergic and non-allergic patients was increased primarily at the NSB (Figure 3). There were no significant differences between the allergic and non-allergic groups ($p>0.05$). Venous sinusoids were more common in the inferior turbinate than in the NSB (Figure 4). There was no difference in the predominance of venous sinusoids between allergic and non-allergic patients (Table 1).

Discussion

The nasal cavity plays a role in respiration, voice, humidification and cleaning of foreign bodies from inspired air. The nasal septum is a part of the nasal cavity, and is covered with respiratory epithelium, including vascular and glandular structures (4). The NSC is a region in the nasal septum that is rich in glandular cells (1). It is the thickest part of the nasal septum and the narrowest portion of the nasal cavity in the nasal valve region; therefore, any changes in volume of the NSC may cause nasal obstruction (6, 7). There have been a limited number of histological and anatomical studies about this mystical region. In one study, researchers reported that the mucosal thickness of the septum and nasal septal body at the level of the nasal valve region may be decreased by elevation of the mucoperichondrium even without any cartilage resection for correction of septal deviation, thereby relieving the nasal obstruction (8). In another study, the mean thickness of the NSC was calculated to be about 5 mm, and the researchers reported that the linear nasal airway stream was improved even after shaving this region (1). Vascular swell bodies have also been described in the proximal nasal cavities of rats and rabbits in studies of the nasal cycle (1). Our study confirms that the NSC mucosa is rich in seromucinous glands and venous sinusoids and is the thickest part of the septum at the level of the nasal valve, as in the Saunders study (8). These properties have important clinical implications. These seromucinous glands are mainly responsible for the humidification of the nasal cavity, and any damage to this region may lead to nasal dryness post-operatively. Therefore, any plan for NSC reduction to improve nasalairflow should take into consideration the presumed protective role of this glandular tissue. On the other hand, changes in volume of venous structures especially at the level of the nasal valve region affect nasal airflow during inspiration and expiration.

Although all structures of the nasal cavity include sinusoids, they are most abundant in the inferior turbinate. This explains the greater vasoconstrictive potential of the inferior turbinate, as revealed by MRI and CT scanning (3, 9, 10). Even though sinusoids are not as abundant in the NSC region, changes in the volume of sinusoids in the nasal valve region including the NSC may lead to nasal obstruction more rapidly and more frequently than in the inferior turbinate. One study concluded that the NSC may play a larger role in directing airstreams laterally toward the turbinates than in regulating nasal resistance (8). In another study, researchers used CT scans to evaluate congested and decongested inferior turbinates (11). They found that the volume of the inferior turbinate was changed a few millimeters at the level of the nasal valve, influencing the nasal airway. They did not focus on the volume of the NSC during congestion and decongestion, nor did they evaluate the volume and respiratory effects of the NSC on the nasal cavity (11). In our study, although CT scans were obtained, we were also unable to evaluate the congested and decongested conditions of these structures.

It is well known that the nasal mucosa is oedematous and thicker in allergic patients. Our study showed that the NSC mucosa is thicker in allergic patients than in non-allergic patients; however, there was no significant difference histopathologically between the two groups. The incidence of nasal obstruction in allergic patients might be more common due to the increased thickness of the NSC, not due to changes in glandular and vascular histopathology at the level of the nasal valve. Therefore, any pathology at the level of the NSC, including septal deviation and infection, may lead to more common and severe nasal obstruction in allergic patients than in non-allergic patients.

This explains the clinical importance of allergic patients whose social life is disturbed due to symptoms such as nasal obstruction, rhinorrhea and nasal discharge. Although the NSC was thicker in allergic patients than in non-allergic patients, there were no histopathological differences between the two groups in our study. This might be due to congestion and hypertrophy of the mucosal glands in allergic patients. There was also infiltration of eosinophils and lymphocytes into the mucosa, leading to oedema, increased thickness of the basal membrane and an increased distance between cells in allergic patients. The migration of eosinophills in the NSC in response to allergy may lead to a thicker mucosa. Medical treatment was withheld for at least 4 weeks before surgery, and therefore the nasal mucosa was oedematous due to allergy. This may explain the thickness of the NSC in tomographic images from allergic patients. Adequate treatment of allergy in patients with nasal obstruction may improve their symptoms without any surgical procedure especially those with nasal obstruction at the level of the nasal valve.

Interestingly, although the inferior septal mucosa has glandular and vascular structures similar to those of the septal swell body, it is much thinner than the septal swell body and therefore the physiological and resistance effects are much less prominent than in the NSC.

One limitation of our study was the difference in age among the limited numbers of patients, which may have influenced the histopathological results because all cell characteristics change with age. The range in age of patients was wide. This may have influenced the incidence of glandular cells, which changes with age. Another limitation was that we were unable to evaluate the results of septoplasty in allergic and non-allergic patients.

Conclusion

The NSC is the thickest part of the nasal septum and the narrowest part of the nasal cavity. Therefore, any changes in this region may lead to changes in humidification, dysfunction and nasal obstruction. These changes in the NSC as they relate to exposure to environmental factors and allergens are not well studied.

Conflict of Interest
No conflict of interest was declared by the authors.

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Author Contributions
Concept - U.T., A.S.S., A.D.; Design - O.Y., E.A.; Supervision - G.H., U.T.; Funding - U.T.; Materials - A.S.S.; Data Collection and/or Processing - O.Y., U.T., E.A.; Analysis and/or Interpretation - E.A.; Literature Review - A.S.S., U.T.; Writer - U.T.; Critical Review - U.T., Ö.Y.

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