

Findings of Nasal Mucosa Cytological Analysis in Integrated Nasal Cavity Disorders

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ABSTRACT

The objective of this study was to examine the cytomorphological characteristics of nasal mucosa smears in patients presenting with combined intranasal structural pathologies. A comprehensive analysis of the cellular composition within the rhinocytogram was performed, evaluating the status of the ciliated epithelium, mucus-secreting cells, inflammatory and immunocompetent cell types, as well as the nature of the microflora. The findings revealed that in this patient population, dystrophic alterations in epithelial cells, moderate hyperplasia of goblet cells, and a neutrophilic inflammatory response were the predominant features. Indicators of a chronic inflammatory process, characterized by compromised mucociliary clearance and persistence of microbial flora, were observed. The results underscore the critical role of combined anatomical and functional abnormalities in the development and sustenance of chronic nasal mucosa pathology, highlighting their practical significance for enhancing diagnostic and therapeutic strategies.

Keywords: Ciliated epithelium, Nose, Nasal mucosa, Cell

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INTRODUCTION

Chronic diseases of the nasal cavity occupy one of the leading positions in the structure of upper respiratory tract pathology and are characterized by high prevalence, prolonged course, and significant impact on patients' quality of life¹. Conditions accompanied by combined pathologies of intranasal structures, in which anatomical changes are coupled with functional disorders of nasal breathing and mucociliary clearance, are of particular clinical significance². Such forms of diseases are often marked by resistance to standard conservative therapy and a tendency towards chronicity of the inflammatory process³.

The mucous membrane of the nasal cavity performs barrier, protective, secretory, and immunoregulatory functions, providing primary protection of the respiratory tract against adverse environmental factors⁴. Under normal conditions, the structural integrity of the ciliated epithelium and adequate mucus production contribute to effective cleansing of the nasal cavity and maintenance of local homeostasis. However, with prolonged exposure to inflammatory and mechanical factors, a restructuring of the mucous membrane's cellular composition occurs, accompanied by dystrophic changes in the epithelium and disruption of physiological defense mechanisms⁵.

The disruption of mucociliary transport plays a crucial role in the pathogenesis of chronic nasal cavity diseases, leading to secretion stagnation, alterations in its physicochemical properties, and the creation of favorable conditions for the persistence of pathogenic microflora⁶. Anatomical deformities of intranasal structures exacerbate these processes, forming a vicious cycle of chronic inflammation and functional obstruction⁷. Under these conditions, the mucous membrane is subjected to constant irritation, which is reflected in changes to the ratio of epithelial, inflammatory, and immunocompetent cells⁸.

Rhinocytological examination is an informative method for assessing the condition of the nasal mucosa, allowing for the objectification of the nature of the inflammatory reaction and the degree of morphofunctional disorders⁹. Analysis of the cellular composition of smears enables the identification of the predominant type of inflammation, assessment of the pathological process activity, and determination of the role of bacterial and immune factors in its maintenance. Special attention is given to the quantitative assessment of ciliated epithelium, goblet cells, neutrophils, lymphocytes, eosinophils, and macrophages, as well as the detection of microflora¹⁰.

Despite accumulated clinical experience, data on cytomorphological changes in the nasal mucosa of patients with combined pathologies remain insufficiently systematized, limiting the possibilities of a pathogenetically justified approach to treatment¹¹. In this regard, studying the features of rhinocytograms in this category of patients represents an urgent scientific and practical task aimed

at deepening the understanding of chronic inflammation mechanisms and optimizing diagnostic and treatment strategies.

A rhinocytological examination was conducted on 1 groups of 63 patients with nasal septum deviation and chronic catarrhal rhinitis in the absence of clinical and instrumental signs of internal nasal valve pathology. The aim of the study was to assess the cellular composition of nasal secretions and the nature of inflammatory changes in the nasal mucosa under conditions of preserved internal nasal valve architecture. Material collection was carried out using the standard method from the surface of the mucous membrane of the inferior nasal turbinates, followed by the preparation of smears, Romanovsky-Giemsa staining, and microscopic analysis at a magnification of $\times 1000$. Quantitative assessment of cellular elements was performed in at least 10 fields of view with subsequent calculation of average values. Statistical data processing was carried out using parametric and non-parametric statistical methods.

The total cellularity of the rhinocytogram in this group of patients was elevated; however, the degree of its increase was less pronounced compared to patients with combined internal nasal valve pathology. The average total number of cells in the field of view was 47.9 ± 3.9 , which significantly exceeded the normal range ($p < 0.001$) but was statistically significantly lower than in cases with narrowing of the internal nasal valve ($p < 0.01$). Increased cellular density of nasal secretions was detected in 53 out of 63 patients, which amounted to 84.0%, indicating the presence of a chronic inflammatory process in the nasal mucosa even in the absence of a pronounced valvular component of obstruction (**Table 1**).

Epithelial cells were identified in all analyzed smears. The average proportion of cylindrical ciliated epithelium was $44.3 \pm 3.5\%$ of the total cell population, which was notably higher compared to patients with valvular pathology, suggesting better preservation of epithelial lining structure. Evidence of dystrophic changes in epithelial cells was observed in 31 patients (49.2%), with degeneratively altered epithelia averaging $14.6 \pm 1.8\%$, significantly lower than in patients with internal nasal valve narrowing ($p < 0.01$). These changes included moderate cytoplasmic vacuolization, partial ciliary disorganization, and minor disruptions in cell membrane contours. The number of goblet cells in this group showed an increase relative to physiological norms, though the level of hyperplasia for mucus production was moderate. The average goblet cell proportion was $9.1 \pm 1.2\%$, with 35 patients (55.5%) showing values exceeding 8%. Statistical analysis indicated a significant deviation from normal values ($p < 0.05$), yet these figures remained substantially lower compared to individuals with combined valvular pathology ($p < 0.01$). Moderate mucus hypersecretion appeared to reflect compensatory mechanisms associated with chronic catarrhal inflammation, without inducing severe aerodynamic disturbances. Neutrophilic

Table 1: Rhinocytogram in patients without narrowing of the internal nasal valve.

Cellular elements and indicators	Value
Epithelial cells	Found in 100% of patients
Cylindrical ciliated epithelium, % (M ± SD)	44.3 ± 3.5
Patients with dystrophic changes in epithelium	28 (49.1%)
Degeneratively altered epithelial cells, % (M ± SD)	14.6 ± 1.8
Significance of differences from the valve pathology group	$p < 0.01$
Goblet cells, % (M ± SD)	9.1 ± 1.2
Increase >8%	31 (54.4%)
Statistical significance of differences from the norm	$p < 0.05$
Statistical significance of intergroup differences	$p < 0.01$
Neutrophil leukocytes, % (M ± SD)	26.8 ± 3.1
Neutrophils >25%	36 (63.2%)
Neutrophils with signs of destruction	11 (19.3%)
Statistical significance of differences from the norm	$p < 0.001$
Statistical significance of intergroup differences	$p < 0.01$
Lymphocytes, % (M ± SD)	8.9 ± 1.3
Lymphocytes >10%	17 (29.8%)
Statistical significance of deviation from the norm	$p < 0.05$
Eosinophils, % (M ± SD)	5.8 ± 1.0
Eosinophilia (>5%)	19 (33.3%)
Statistical significance of deviation from the norm	$p < 0.05$
Macrophages, % (M ± SD)	3.6 ± 0.7
Macrophages >4%	15 (26.3%)
Correlation with disease duration	$r = 0.44; p < 0.01$
Presence of microflora	45 (78.9%)

Note: Data are presented as mean ± standard deviation (M ± SD). Numbers in parentheses indicate absolute values and their percentage of the total number of examined patients in this group. Normative indicators for the rhinocytogram were adopted according to generally accepted cytomorphological criteria. The statistical significance of differences was assessed using parametric analysis methods; differences were considered significant at $p < 0.05$. Correlation analysis was performed using Pearson's correlation coefficient.

leukocytes constituted the predominant inflammatory component within the rhinocytogram, though their levels were lower compared to patients with internal nasal valve issues. The average neutrophil concentration stood at $26.8 \pm 3.1\%$, with an increase beyond 25% noted in 40 patients (63.5%). Evidence of neutrophil destruction was observed in 15 patients (23.8%), suggesting a less intense inflammatory response. Differences compared to normative values were highly significant ($p < 0.001$), while intergroup comparisons pointed to less severe neutrophilic inflammation ($p < 0.01$). The lymphocytic component was present at moderate levels, with an average percentage of lymphocytes at $8.9 \pm 1.3\%$. Levels exceeding 10% were identified in 21 patients (33.3%), consistent with chronic immune-driven inflammation. These values showed borderline but statistically significant differences when compared to physiological norms ($p < 0.05$). Raised lymphocyte levels were more frequently found in patients with a history of chronic rhinitis spanning more than five years. Eosinophils were observed more frequently in this group compared to individuals with valvular pathology, but their levels generally remained low. Average eosinophil content was $5.8 \pm 1.0\%$, with nasal secretion eosinophilia (>5%) documented in 19 patients (30.1%). Clinical findings linked these cases to vasomotor dysfunction of the nasal mucosa and heightened sensitivity to environmental irritants, indicating a mixed neuroimmune inflammatory response despite the absence of overt allergic rhinitis.

These figures significantly deviated from normative values ($p < 0.05$). Macrophages were identified in 44 patients (69.8%), with an average level of $3.6 \pm 0.7\%$, which was slightly higher than in groups with valvular pathology. Elevated macrophage levels (>4%) were found in 18 patients (28.5%), reflecting heightened phagocytic activity and mucosal remodeling due to chronic inflammation. Correlation analysis demonstrated a significant link between macrophage levels and disease duration ($r = 0.44; p < 0.01$). Microflora was detected in smears from 49 patients (77.7%), predominantly consisting of extracellular coccid flora. Intracellular bacterial localization was noted in only 17 patients (26.9%), significantly less frequent than among those with internal nasal valve narrowing ($p < 0.01$). This indicated reduced bacterial persistence and improved conditions for nasal cavity aeration. A comparison of rhinocytological parameters in subgroups based on varying degrees of nasal septal deviation revealed that severe deviation (grade III) was associated with a notable increase in neutrophilic components ($29.7 \pm 3.2\%$ versus $23.4 \pm 2.8\%$; $p < 0.05$) and a higher proportion of degeneratively altered epithelial cells ($17.2 \pm 2.1\%$ versus $11.9 \pm 1.6\%$; $p < 0.05$). Meanwhile, goblet cell and eosinophil levels did not present significant variations, underscoring the secondary influence of anatomical factors without substantial involvement of the internal nasal valve. Through correlation analysis, a significant association was identified between neutrophil

levels and the severity of nasal congestion symptoms, as measured by the visual analog scale ($r = 0.47$; $p < 0.001$).

CONCLUSIONS

Consequently, the findings from a rhinocytological examination involving 63 patients exhibiting nasal septum deviation and chronic catarrhal rhinitis, absent of internal nasal valve pathology, reveal a moderately pronounced chronic inflammatory process within the nasal mucosa, predominantly of a neutrophilic nature, while maintaining the structural integrity of the epithelial layer and exhibiting less pronounced mucus hypersecretion. The observed alterations are statistically significant; however, they demonstrate a lesser degree of severity when compared to patients suffering from the valvular form of nasal obstruction. This underscores the pivotal role of the internal nasal valve in the pathogenesis of inflammatory and functional disorders associated with nasal breathing.

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