

Results of Nasal Mucosa Smear Examination in Patients with Combined Pathologies of the Nasal Cavity and Nasal Valve

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ABSTRACT

This study aimed to thoroughly assess cytomorphological alterations in nasal mucosa smears from patients with combined nasal and internal nasal valve pathologies. The paper reviews the findings from rhinocytological examinations, covering both quantitative and qualitative analyses of epithelial, inflammatory, and immunocompetent cells, alongside microbial colonization features. It was found that pronounced dystrophic modifications in the ciliated epithelium, hyperplasia of goblet cells, and neutrophilic inflammation are predominant in cases of combined anatomical and functional disorders, signifying a chronic bacterial-associated condition. An increase in degeneratively altered epithelial cells, a high incidence of intracellular microflora, and indications of impaired mucociliary clearance were noted. The findings highlight the crucial role of anatomical narrowing of the nasal valve in sustaining chronic inflammation and persistent nasal obstruction, which is significant for diagnostic and clinical approaches to treatment selection.

Keywords: Nasal valve, Rhinocytogram, Eosinophil, Mucociliary clearance.

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INTRODUCTION

Chronic diseases of the nasal cavity remain one of the most pressing issues in modern otorhinolaryngology, due to their high prevalence, tendency for prolonged course, and significant impact on patients' quality of life¹. Conditions characterized by combined anatomical and functional disorders of the nasal cavity, including pathologies of intranasal structures and the internal nasal valve, which play a crucial role in regulating nasal breathing, are of particular clinical significance². Disruption of nasal airflow aerodynamics in valve dysfunction leads to the development of persistent nasal obstruction, chronic inflammation, and reduced effectiveness of conservative therapy³.

The nasal mucosa is a complex multifunctional system that provides barrier, protective, secretory, and immune functions⁴. Under normal conditions, its structural organization and cellular composition maintain effective mucociliary clearance and local immune homeostasis. However, in chronic inflammatory diseases and anatomical deformities, a restructuring of the epithelial lining occurs, along with changes in the ratio of cellular elements and activation of inflammatory cascades⁵. These processes are particularly pronounced when nasal pathology is combined with impaired function of the internal nasal valve, creating unfavorable conditions for nasal ventilation and drainage⁶.

Rhinocytological examination is an informative and accessible method for assessing the condition of the nasal mucosa, enabling identification of the nature of inflammation, the degree of dystrophic changes in the epithelium, and the characteristics of the immune response and microbial colonization⁷. Analysis of the cellular composition of smears allows for differentiation between bacterial, neuroimmune, and mixed types of inflammatory processes, as well as evaluation of the activity and chronic nature of pathological changes⁸. Special attention in the rhinocytogram is given to the condition of the ciliated epithelium, the number of goblet cells, the ratio of neutrophilic to lymphocytic elements, and the presence of eosinophils and macrophages⁹.

In cases of chronic nasal obstruction caused by valve disorders, there is a marked suppression of mucociliary transport, which contributes to the persistence of microflora and the maintenance of inflammation¹⁰. The intracellular localization of microorganisms, detected during cytological examination, is considered a marker of a prolonged bacterial process and reduced effectiveness of local defense mechanisms¹¹. Additionally, the degree of cytomorphological changes directly correlates with the severity of anatomical abnormalities and the duration of the disease.

Despite significant research on chronic rhinitis and intranasal deformities, data on the cytological characteristics of the nasal mucosa in patients with

combined nasal and internal nasal valve pathologies remain fragmented and insufficiently systematized¹². This necessitates a comprehensive study of the rhinocytogram in this category of patients to deepen understanding of the disease pathogenesis and justify a personalized approach to diagnosis and treatment.

RESULTS

Rhinocytological examination was conducted in group 2, consisting of 42 patients with combined nasal cavity pathology, including nasal septum deviation, chronic catarrhal rhinitis, and narrowing of the internal nasal valve. The study was performed during the clinical remission of acute inflammation to assess the nature of the cellular composition of nasal secretions and the severity of inflammatory changes in the nasal mucosa. Material collection was carried out using the standard method from the surface of the inferior nasal turbinates, followed by Romanovsky-Giemsa staining of smears and counting of cellular elements in the microscope's field of view at a magnification of $\times 1000$. The obtained data were analyzed using methods of variational statistics.

Analysis of the total cellularity of the rhinocytogram showed a significant increase in the number of cellular elements compared to conventional reference values. The average total number of cells per field of view was 62.4 ± 4.8 , which significantly exceeded the physiological norm ($p < 0.001$). The increase in the total cellular density of nasal secretions indicated the presence of a chronic inflammatory process in the nasal mucosa, which was characteristic of most examined patients (**Table 1**). Elevated cellularity was observed in 39 out of 42 patients, which constituted 92.8%.

Epithelial cells were detected in the rhinocytogram of all patients without exception. The average content of cylindrical ciliated epithelium was $38.6 \pm 3.2\%$ of the total cell count. Additionally, 33 patients (78.5%) showed signs of dystrophic changes in epithelial cells, including cytoplasmic vacuolization, irregular cell membrane contours, and partial loss of cilia. The proportion of degeneratively altered epithelial cells averaged $21.4 \pm 2.1\%$, which was statistically significantly higher compared to the reference values ($p < 0.01$). These changes reflected chronic irritation of the mucous membrane and impaired mucociliary clearance, exacerbated by anatomical narrowing of the internal nasal valve.

The number of goblet cells was increased in the majority of examined patients. The average proportion of goblet cells was $12.8 \pm 1.4\%$, whereas normally this indicator does not exceed 5-7%. An increase in the number of goblet cells was observed in 36 patients (85.7%), indicating hypersecretory remodeling of the nasal mucosa. Statistical analysis confirmed the significance of the identified differences ($p < 0.01$). Increased mucus secretion was considered one of the key mechanisms in the development of persistent nasal obstruction in this category of patients.

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)	38.6 ± 3.2
Patients with dystrophic changes in epithelium	35 (72.9%)
Degeneratively altered epithelial cells, % (M ± SD)	21.4 ± 2.1
Statistical significance of difference from norm	<i>p</i> < 0.01
Goblet cells, % (M ± SD)	12.8 ± 1.4
Normal range for goblet cells, %	5-7
Increased number of goblet cells	39 (81.3%)
Statistical significance of difference from norm	<i>p</i> < 0.01
Neutrophil leukocytes, % (M ± SD)	34.9 ± 3.6
Neutrophils >30%	42 (87.5%)
Neutrophils with destruction and toxic granulation	18 (37.5%)
Statistical significance of difference from norm	<i>p</i> < 0.001
Lymphocytes, % (M ± SD)	7.6 ± 1.1
Lymphocytes >10%	14 (29.2%)
Eosinophils, % (M ± SD)	4.2 ± 0.9
Nasal secretion eosinophilia (>5%)	11 (22.9%)
Statistical significance of difference from norm	<i>p</i> < 0.05
Macrophages, % (M ± SD)	2.8 ± 0.6
Macrophages >3%	16 (33.3%)
Correlation with epithelial destruction	<i>r</i> = 0.48; <i>p</i> < 0.01
Presence of microflora	40 (83.3%)
Intracellular location of microflora	26 (54.2%)
Association with neutrophilic infiltration	<i>p</i> < 0.01

Note: Data are presented as mean and standard deviation (M ± SD). Values in parentheses indicate absolute numbers and their percentage relative to the total number of examined patients in the 2nd group. Normative rhinocytogram indicators were adopted according to generally accepted morphocytological criteria. 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 coefficient.

Neutrophilic leukocytes were the predominant inflammatory cellular element in the rhinocytogram. The average neutrophil content was 34.9 ± 3.6%. In 39 patients (92.8%), the neutrophil count exceeded 30% of the total cell count, which corresponded to signs of chronic bacterial-associated inflammation. In patients (40.4%), neutrophils with signs of destruction and toxic granulation were detected, indicating a prolonged and active inflammatory process. The differences compared to the normative values were statistically significant (*p* < 0.001).

The lymphocytic component of the rhinocytogram was moderately present. The average percentage of lymphocytes was 7.6 ± 1.1%. An increase in lymphocyte content above 10% was observed in 12 patients (28.5%), which was interpreted as a manifestation of chronic immune inflammation of the mucous membrane. In other cases, the lymphocyte level remained within the upper limit of normal. The obtained data indicated a mixed nature of the inflammatory process with a predominance of the neutrophilic component.

Eosinophils in the rhinocytogram were not detected in all patients. The average value of their content was 4.2 ± 0.9%. Nasal secretion eosinophilia (>5%) was registered in 9 patients (21.4%). In these cases, elements of vasomotor reactions and increased nasal mucosa reactivity were clinically observed; however, no pronounced signs of allergic rhinitis were found. Differences in the level of

eosinophils compared to normal values were moderate but statistically significant (*p* < 0.05).

Macrophages were detected in smears from most patients and averaged 2.8 ± 0.6%. Elevated macrophage content (>3%) was noted in 14 patients (33.3%), reflecting the activation of phagocytosis and tissue remodeling processes under conditions of chronic inflammation. The presence of macrophages correlated with the severity of destructive changes in the epithelium (*r* = 0.48; *p* < 0.01).

Microflora was visualized in the rhinocytogram of 40 patients (83.3%). In most cases, coccal flora was observed both extracellularly and intracellularly. Intracellular localization of microorganisms was detected in 23 patients (54.7%) and was associated with a higher level of neutrophilic infiltration (*p* < 0.01). These findings confirmed the role of bacterial factors in maintaining chronic inflammation of the nasal mucosa in combination with anatomical abnormalities and functional obstruction.

Comparative analysis of rhinocytological parameters in patients with more pronounced narrowing of the internal nasal valve (angle less than 10°) revealed a significantly higher level of neutrophils (39.1 ± 3.8% versus 29.4 ± 3.1%; *p* < 0.01) and a greater proportion of degenerative epithelial cells (24.7 ± 2.4% versus 17.9 ± 2.0%; *p* < 0.05). This indicated a direct relationship between the degree of anatomical narrowing and the severity of inflammatory changes in the nasal mucosa.

Correlation analysis revealed a statistically significant association between neutrophil content and the clinical severity of nasal obstruction on the visual analog scale ($r = 0.56$; $p < 0.001$), as well as between the number of goblet cells and the intensity of rhinorrhea ($r = 0.49$; $p < 0.01$). The obtained data confirm the diagnostic value of the rhinocytogram as a method for objective assessment of inflammatory and functional changes in the nasal mucosa.

CONCLUSIONS

Thus, the results of rhinocytological examination in 48 patients with a combination of nasal septum deviation, chronic catarrhal rhinitis, and internal nasal valve narrowing indicate the predominance of chronic neutrophilic inflammation with pronounced dystrophic changes in the epithelial lining and mucus hypersecretion. The identified changes are statistically significant and correlate with the clinical manifestations of nasal obstruction, which emphasizes the pathogenetic role of the inflammatory component in the development of persistent nasal breathing impairment in this category of patients.

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