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Research Article

CLINICAL-FUNCTIONAL AND MICROBIOLOGICAL INDICATORS OF THE MUCOUS MEMBRANE OF THE NASAL CAVITY IN PATIENTS WITH CHRONIC POLYPOUS RHINOSINUSITIS

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ABSTRACT

The functional state of the nose have shown a decrease in respiratory function in patients with chronic " eosinophilic " polypous rhinosinusitis, that is, nasal patency (FEF75/MOS75) was - 2 9 , 4 ?0, 8 (p<0.001 in relation to the control group), prolongation of the transport function time (36.3±0.86 minutes) (p < 0.001 in relation to the control group), increase in pH (7.4 ±0.01) (p <0.001 relative to the control group), prolongation of absorption time (89.9±6.6 minutes) (p<0.01 relative to the control group), as well as increased excretory function (58.4±0.8 mg) (p<0.001 relative to the control group). Patients in both groups showed impaired nasal function , which can hamper the effect of topical medications on the nasal mucosa, which in turn reduces the effectiveness of treatment. This circumstance must be taken into account when treating these patients.

Microbiological research was carried out in the bacteriological laboratory of the III clinic of the Tashkent Medical Academy, a sample was taken from the nasal cavity of 150 patients. At the same time, determination of the sensitivity of the identified microflora to various antibiotics showed that in almost all cases the monoculture and microbial associations were highly sensitive to cephalosporins, sulfonamides and macrolides. However, it should be noted that in patients with " neutrophilic " polypous rhinosinusitis, the nasal microflora was revealed as a monoculture, which was highly sensitive to macrolide antibiotics.

KEYWORDS

Microbial associations, polyp, nose, mucous membrane.

INTRODUCTION

In the overall morbidity structure of ENT organs, lesions of the nose and paranasal sinuses firmly took first place both in the analysis of visits to the clinic and in the group of patients undergoing treatment in a hospital setting, with rhinosinusitis accounting for 44–46% of all patients with ENT pathology [5].

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Up to 15% of the world's adult population suffers from various forms of sinusitis. Chronic rhinosinusitis (CRS) is one of the 10 most common diagnoses in outpatient practice [2]. Chronic rhinosinusitis can be divided into 2 groups: CRS without PN (nasal polyp) and CRS with PN - CPRS (chronic polypous rhinosinusitis). Chronic polypous rhinosinusitis (CPRS) is a multifactorial disease in which the mucous membrane of the nose and paranasal sinuses is affected, immune and anti-inflammatory mechanisms are involved, leading to the formation of a chronic inflammatory process and the formation of polypous tissue. The primacy in the development of the anatomy, physiology and pathology of the paranasal sinuses was given to Walter Messerklinger and H. Stammberger, from Austria, their work on the ventilation of the ethmoidal cells was key to understanding the anatomy of the lateral wall of the nasal cavity and its mucociliary transport, the communication of the paranasal sinuses with the nasal cavity [1] .

According to its anatomical structure, the nasal cavity is the most complex organ of the human body. In a study conducted by V.S. Piskunov (2002) found that individual anatomical structures of the nasal cavity or their complexes develop abnormally in the embryonic or postnatal periods; as a result, at some stage of life, the formed anomaly can lead to functional disorders that contribute to the development of the pathological process in the mucous membrane of the nose and paranasal sinuses However, to this day, the literature has not sufficiently covered the features of chronic polypous rhinosinusitis depending on the anatomical structure of the nasal cavity and paranasal sinuses.

There are a number of theories of the etiology of nasal polyposis, and they are not mutually exclusive: bacterial and fungal infection, superantigen stimulation of the immune system, biofilm formation, anatomical abnormalities of the osteomeatal complex, ciliary dysfunction, allergies, secondary immunodeficiency [4-7].

In this regard, the opinion of S.L. is of interest. Trofimenko (2010), according to which diseases accompanied by the formation of nasal polyps are divided into 5 groups. The first group consists of systemic genetically determined diseases in the form of Kartagener syndrome and cystic fibrosis, the second group - chronic polypous-purulent rhinosinusitis (neutrophil polyps), the third group - local pathology in the osteomeatal complex with impaired mucociliary clearance in the paranasal sinuses and the formation of a productive process in them with the development choanal polyps, the fourth group - chronic infectious-allergic rhinosinusitis with the final stage of development in the form of chronic polyposis-allergic rhinosinusitis (eosinophilic polyps), the fifth group - the "asthmatic triad" as a pseudo-allergic disease caused by a violation of arachidonic acid metabolism: aspirin-induced polyps nose [8-12].

S.V. Ryazantsev et al. (2006) consider nasal polyposis and SNP as a multifactorial etiological syndrome that occurs in individuals predisposed to a specific tissue reaction [13]. According to this theory, the formation of nasal polyps is associated with congenital predisposition and exposure to environmental factors, such as mechanical, physical, chemical, biological factors (viruses, bacteria, fungi, allergens). At the same time, a congenital predisposition is considered to be a violation of the reactivity of the parasympathetic nervous system, immunity, mucociliary transport, hypersensitivity of the mucous membrane, defects in membranes and DNA in the cell nuclei. The combination of these two factors includes pathogenetic mechanisms, that is, they lead to disruption of neurotrophic innervation, degranulation

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of mast cells, release of biologically active substances, which in turn increase vascular permeability, followed by tissue edema and the formation of polyps.

According to another theory proposed by M.Yu. Korkmazov (2010), with polypous sinusitis, microcirculation in the area of the middle nasal passage changes in the form of vasomotor reactions, narrowing of arterioles and a decrease in the number of functioning capillaries, which lead to the accumulation of metabolic products and retention of tissue fluid, which contributes to the development of edema [14].

N. N. Naumenko et al. (2005) suggest that with polypous rhinosinusitis, a violation of the adaptive-trophic function of the autonomic nervous system is important, which contributes to the development of neurodystrophic changes in the nasal mucosa, leading to the formation of polyps [15-22].

V. S. Piskunov (2006) believes that disruption of the aerodynamics of the nose due to deformations of the nasal septum leads to a slowly developing inflammatory process of the nasal mucosa, manifested by the formation of a polyp in the absence of pathological changes in the paranasal sinuses [23].

In recent years, the role of impaired arachidonic acid metabolism, which leads to "aspirin intolerance", has been intensively studied in patients with CPRS [5]. The classic clinical picture of the "aspirin" triad involves the presence of bronchial asthma in combination with eosinophilic rhinitis or CPRS, the manifestations of which sharply increase after taking non-steroidal anti-inflammatory drugs (NSAIDs) [24-26]. In this regard, the importance of leukotrienes in the development of allergic inflammation is very significant. They increase vascular permeability, promote the mobilization and activation of pro-inflammatory cells in the airways, participate in the release of other pro-inflammatory agents, increase the secretory activity of glands, and can enhance the effect of other allergy mediators, for example, histamine [27], as a result of which "aspirin-induced" polyps develop [28].

The purpose of our study was to study functional and microbiological parameters in patients with chronic polypous rhinosinusitis.

Material and research methods.

In accordance with the purpose of the study and to fulfill the assigned tasks, clinical studies were conducted in 150 patients with CPRS who were examined and treated in the ENT department of the multidisciplinary clinic of the Tashkent Medical Academy in 2018-2019. The control group consisted of 20 healthy volunteers aged 19 to 64 years from among the employees of the multidisciplinary clinic of the Tashkent Medical Academy. All volunteers included in the study did not suffer acute diseases, primarily of an infectious nature, during the last month before the start of the study, and did not have chronic pathology of inflammatory origin. As can be seen from the table, the majority of patients were aged from 41 to 50 years (28.4%). At the same time, the number of males turned out to be slightly larger than females (1.5:1). The overwhelming number of adult patients were people of working age (71.6% of patients aged 21 to 60 years), which emphasizes the social significance of this problem.

Results and their discussions.

The study of the function of mucociliary transport was carried out in 150 patients with CPRS using a standard saccharin test. To compare the obtained indicators, we examined 20 volunteers who did not suffer from pathology of the nasal cavity and paranasal sinuses. In

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healthy individuals, the time from the moment of applying saccharin to the appearance of a sweet taste in the mouth ranged from 5 to 19 minutes.

When studying the functional characteristics of the mucous membrane of the nasal cavity, all the examined patients were conditionally divided into groups depending on the form of CPRS. The results of the study are presented in Table 4.5.

Table 4.5

Mucociliary clearance of the nasal cavity in the examined patients

Study	Patients with EPRS , n =90	Patients with NPRS, n =60	Control group, n=20
Mucociliary clearance, min	36.3±0.86***	37.5±0.74***	11.5±1.4

Note: * - differences relative to the control group data are significant (* - P <0.001)**

changes in the concentration of hydrogen ions (pH of nasal secretions) using special indicator paper. The pH value determined in the nasal cavity is more reliable than the pH determined after nasal mucus is removed from the nasal cavity. Nasal secretions extracted from the nasal cavity quickly lose carbon dioxide, which leads to a significant shift in the active reaction in the alkaline direction. The results of the study of the concentration of hydrogen ions are presented in Table 4.6.

Table 4.6

pH of the nasal cavity in the examined patients

Study	Patients with EPRS , n =90	Patients with NPRS, n =60	Control group, n=20
pH	7.4 ±0.01***	7.3 ±0.01*** ^^^	7.0 ±0.01

Note: * - differences relative to the data of the control group are significant (* - P <0.001), ^ - differences relative to the data of the " GHC" group are significant (^^^ - P <0.001)**

As can be seen from Table 4.11, in patients with chronic recurrent polyposis rhinosinusitis, the pH averaged 7.4 ± 0.01, and in patients with chronic purulent polyposis – 7.3 ± 0.01. The data obtained indicate a change in the concentration of hydrogen ions pH of the nasal mucosa in patients with chronic sinusitis. Moreover, a pH shift towards the alkaline side is characteristic.

Attention was also paid to the study of the absorption and excretory functions of the nasal mucosa, the results of which are presented in Table 4.7.

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Table 4.7

Indicators of the absorption function of the nasal cavity in the examined patients

Study	Patients with EPRS , n =90	Patients with NPRS, n =60	Control group, n=20
Pupil reaction time, min	89.9±6.6**	80.3±4.0**	6 8.2 ± 0.6 _ _

Note: * - differences relative to the control group data are significant (- P <0.01)**

As can be seen from Table 4.12, the reaction time of the pupil in chronic polypous rhinosinusitis averages 89.9±6.6 minutes, and in chronic purulent-polypous rhinosinusitis - 80.3±4.0. The data obtained indicate a violation of the absorption function of the nasal mucosa in patients with chronic sinusitis. Moreover, a decrease in absorption function is observed in patients of all groups.

We also attached great importance to the study of the excretory function of the nose. The results of the study are presented in Table 4.8.

Table 4.8

Indicators of excretory function of the nasal cavity in the examined patients

Study	Patients with EPRS , n =90	Patients with NPRS, n =60	Control group, n=20
Weight of cotton ball, mg	58.4±0.8*** ^	55.7±0.8***	4 1.2 5 ± 0.08 5

Note: * - the differences relative to the data from the control group are significant (* - P <0.001), ^ - the differences relative to the data from patients with EPRS are significant (^ - P <0.05)**

As can be seen from Table 4.13, the weight of the ball after the study in patients with CPRS averaged 58.4 ± 0.8 mg, and in patients with chronic purulent polyposis rhinosinusitis - 55.7 ± 0.8 mg . The study showed that in patients with CPRS, the transport function in the nasal mucosa is disrupted, the pH changes, the absorption function is prolonged, and secretory activity increases due to an increase in excretory function. The indicator of excretory function of the nasal mucosa or secretory activity in patients with chronic sinusitis increases. This suggests that there is overproduction of the mucous and goblet glands, which ultimately affects the function of the ciliated epithelium and the activity of lysozyme, which largely provides the protective properties of nasal mucus.

To determine nasal obstruction, the rhinopneumotachometry method was used and the results of this study were recorded in the form of qualitative and quantitative data. The quantitative results of the study are presented in absolute numbers and as a percentage relative to the norm. The average values of external respiration indicators are given in Table 4.9.

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Table 4.9

Quantitative values of rhinopneumotachometry in the examined patients

Options	Patients with EPRS , n =90	Patients with NPRS, n =60	Control group, n=20
FEV1/FEV1	56.0 ±1.7	56 , 8 ±1.2	58.0 ±1.6
FVC/FVC	93.2 ±2.0	92.9 ±2.0	94.7 ±2.0
FEF75/MOS75	29.4 ±0.8 ^^^	37.9 0.7 ±***	46.0 ±1.2
FEF50/MOS50	37.9 ±1.4	3 8.0 ±0.7	38.6 ±1.5
FEF25/MOS25	80.8 ±1.7	80.9 3.5 _±	81.5 ±1.6
PEF/POS exhalation	36.8 ±1.7	3 7.7 ±1.6	37.5 ±1.7

Note: * - the differences relative to the data from the control group are significant (* - P <0.001), ^ - the differences relative to the data from patients with EPRS are significant (^^^ - P <0.001)**

FEF75, being an indicator of the patency of large bronchi and the nose , showed that in patients with "eosinophilic" polypous rhinosinusitis, the respiratory ability is impaired to a greater extent than in patients with "neutrophilic" polypous rhinosinusitis .

As shown by the analysis of the literature and the results of our research, in the presence of pathology with impaired respiratory ability of the nasal cavity and a significant period of disease, the transport function of the nasal mucosa decreases.

It is known that the climate of our republic negatively affects the functional state of the mucous membranes of the upper and lower respiratory tract. Taking this into account, we needed to choose the least traumatic, optimal method of surgical treatment. Studies of mucociliary transport and rhinopneumotachometry helped us with this.

From the results of the olfactometric study it follows that impaired sense of smell is more common in patients with chronic "eosinophilic" polyposis rhinosinusitis, which is due to the widespread prevalence of the polyposis process in the paranasal sinuses (Table 4.10) .

Table 4.10

Results of olfactometry in the examined patients , abs. (%)

Degree of smell impairment	Patients with EPRS , n =90, abs. (%)		Patients with NPRS, n =60, abs. (%)	
	abs.	%	abs.	%

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Normosmia	18	20.0	31	51.7
Hyposmia:				
- I degree	19	21.1 ***	14	23.3
- II degree	23	25.6	8	13.3
- III degree	19	21.1	7	11.7
Anosmia	1 1	12.2 ***	0	0.0

Thus, functional studies of the nose have revealed that with CPRS, the transport function is disrupted, the pH changes, the absorption time is prolonged, and secretory activity increases due to an increase in excretory function, which contributes to the relapse of the disease.

Bacteriological sampling of material from the nasal cavity was carried out before surgery in all patients. During a bacteriological examination of the nasal mucosa, both pathogenic and conditionally pathogenic flora were sown, represented by Staphylococcus aureus, Coagulase negative Staphylococci, Propionibacterium acnes, Streptococcus viridans, Escherichia coli, Klebsiella pneumoniae, Klebsiella oxytoca, Hemophilus influenza, Neisseria meningitides, Enterobacter spp. , Pr. vulgaris, Pr. mirabilis, Pr. Aerogenosa (Table 4.11).

The sensitivity of the isolated microflora to various antibiotics was also determined. In almost all cases, monocultures and microbial associations were highly sensitive to macrolides.

Table 4.11

Data from a microbiological study of patients with CPRS (n = 150)

Bacteria	Patients with EPRS , n =90		Patients with NPRS, n =60		Control group, n=20	
	abs.	%	abs.	%	abs.	%
Staph . aureus	thirty	33.3	thirty	50.0	2	10.0
Coagulase negative Staphylococci	45	50.0	40	66.7	13	65.0
P. acnes	3	3.3	12	20.0	1	5.0
Str . viridans	4	4.4	6	10.0	0	0
E. _ coli	4	4.4	9	15.0	2	10.0
Kl . pneumoniae	0	0.0	eleven	18.3	0	0
Kl . oxytoca	0	0.0	4	6.7	0	0

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H. influenzae	5	5.6	7	11.7	0	0
N. meningitidis	0	0.0	1	1.7	1	5.0
Enterobacter sp p	3	3.3	7	11.7	1	5.0
Pr. vulgaris	0	0.0	2	3.3	0	0
Pr. mirabilis	1	1.1	2	3.3	0	0
Pr. aerogenosa	0	0.0	1	1.7	0	0

In addition, mycological examination of the contents of the nasal cavity was carried out (Table 4.12). In 24 patients, one or more findings indicating fungal infections were found. 3 patients had clinical and histological findings consistent with sinus mycetoma.

In the remaining patients, the condition was assessed as allergic fungal rhinosinusitis-like syndrome. No invasive fungal infections were detected. Fungal staining of mucus was positive in 5 patients: yeast cells were found in one of them, fungal hyphae were detected in 4. Cultures for Aspergillus were positive in 3 patients: 2 for Aspergillus fumigatus, 1 for Aspergillus niger . In all patients, fungal hyphae were also detected in sinus mucus samples.

Table 4.12

Results of mycological examination of patients with CPRS (n = 150)

Composition of microflora	Patients with EPRS , (n =90)		Patients with NPRS, (n =60)		Control group, (n=20)	
	abs	%	abs	%	abs	%
Paecilomyces	7	7.8	0	0	0	0
Candida albicans	3	3.3	0	0	0	0
Penicillium	5	5.6	0	0	0	0
Aspergillus	3	3.3	0	0	0	0

Thus, a microbiological study showed that in patients with chronic “ eosinophilic ” and “ neutrophilic ” polyps, compared with the control group, a significant predominance of Coag was revealed. neg. Staphylococci and S. aureus. However, the presence of P. acnes, Kl. was considered a feature of “neutrophilic” polyps. Pneumonia and Enterobacter spp. The presence of fungi in the nasal cavity in patients with chronic “ eosinophilic ” polypous rhinosinusitis can also act as an allergen on the body. When comparing

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microbiological studies of patients with " eosinophilic " and " neutrophilic " polyps with the control group, a significant predominance of Coag was revealed. neg. Staphylococci (in 50.0% and 66.6% of cases, respectively, p<0.05) and S. aureus (in 33.3% and 33.3% of cases, respectively, p<0.05). However, the presence of P. acnes (20.0 %), Kl . Pneumonia (18.3%) and Enterobacter spp. (7.0%). An allergological study revealed a positive reaction to allergens in 61.3% of patients with chronic polypous rhinosinusitis ; this was observed mainly in patients with " eosinophilic " polyps; in 38.7% of cases the reaction was negative and was observed in patients with " neutrophilic " polyps.

CONCLUSIONS

the functional state of the nose have shown a decrease in respiratory function in patients with chronic " eosinophilic " polypous rhinosinusitis, that is, nasal patency (FEF75/MOS75) was - 2 9 , 4 0, 8 (p<0.001 in relation to the control group), a decrease in olfactory function to varying degrees, that is, degree I hyposmia was observed in 19 (21.1%), degree II hyposmia - in 23 (25.6%), hyposmia ¬III degree – in 19 (21.1%), anosmia – in 11 (12.2%) patients, prolongation of transport function time (36.3±0.86 minutes) (p < 0.001 relative to the control group), increase in pH (7.4 ±0.01) (p<0.001 relative to the control group), prolongation of absorption time (89.9±6.6 minutes) (p<0.01 relative to the control group), as well as an increase excretory function (58.4±0.8 mg) (p<0.001 relative to the control group), decreased respiratory function in patients with chronic " neutrophilic " polyposis rhinosinusitis, that is, nasal patency (FEF75/MOS75) was - 3 7.9 0.7 _ (p <0.001 in relation to the control group), a decrease in olfactory function to varying degrees, that is, degree I hyposmia was observed in 14 (23.3%) patients, degree II hyposmia - in 8 (13.3%), degree III hyposmia – in 7 (11.7%), normosmia – in 31 (51.7%) patients, prolongation of transport function time (37.5±0.74 minutes) (p < 0.001 relative to the control group), pH shift to the alkaline side (7.3 ± 0.01) (p < 0.001 relative to the control group), prolongation of absorption time (80.3 ± 4.0 minutes) (p < 0.01 relative to the control group), and also an increase in excretory function (55.7 ±0.8 mg) (p<0.001 relative to the control group). Patients in both groups showed impaired nasal function , which can hamper the effect of topical medications on the nasal mucosa, which in turn reduces the effectiveness of treatment. This circumstance must be taken into account when treating these patients.

Microbiological research was carried out in the bacteriological laboratory of the III clinic of the Tashkent Medical Academy, a sample was taken from the nasal cavity of 150 patients. According to the results of the study, both pathogenic and opportunistic flora were identified; in many cases, patients had different morphological compositions of the nasal microflora: 30 (33.3%) patients with " eosinophilic " polyps were found to have S. aureus, 45 (50.0%) %) - Coag. neg. Staphylococci and in 4 (4.4%) - H. influenzae, in 20 (33.3%) patients with " neutrophilic " polyps , S. aureus was found, in 40 (66.6%) - Coag. neg. Staphylococci, in 12 (20.0%) - P. acnes, in 11 (18.3%) - Kl. pneumonia, in 4 (6.7%) - H. influenza, in 4 (6.7%) - Enterobacter spp. At the same time, determination of the sensitivity of the identified microflora to various antibiotics showed that in almost all cases the monoculture and microbial associations were highly sensitive to cephalosporins, sulfonamides and macrolides. However, it should be noted that in patients with " neutrophilic " polypous rhinosinusitis, the nasal microflora was revealed as a monoculture, which was highly sensitive to macrolide antibiotics.

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