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The Role of the Nasal Microbioma in the Diagnosis and Treatment of Chronic Rhinosinusitis

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Resume. Diseases of the paranasal sinuses (BYoB) are the most common pathology in otorhinolaryngology, and the modern environmental situation, the widespread spread of allergic and viral diseases, and a decrease in local and general immunity contribute to its development. Many researchers believe that the incidence of chronic rhinosinusitis (SRS), including chronic polyposis rhinosinusitis (SPRS), has increased worldwide in recent years.

In the development of chronic rhinosinusitis (SRS), the condition of the natural opening of the sinus, which provides aeration and drainage, is of great importance. In the inflammatory process, pathological changes in the area of the hole associated with the anatomical features of the nasal structures, a chronic inflammatory process of the mucous membrane of the sinus occurs, which is accompanied by its structural changes. In addition, other reasons for the transition of the inflammatory process to chronicity are also known: bacterial and fungal infection, as well as superantigen stimulation of the immune system, allergies and immunodeficiency, but the reason for the persistence of infection in a particular patient has not yet been determined. SRS is evaluated as a multifactorial inflammatory process, the cause of its development has not been fully determined, which causes difficulties in the treatment of this disease.

Keywords: Chronic rhinosinusitis, nasal polyps, mucous-purulent drainage, nasal congestion, nasal polyps, allergy, cystic sinusitis.

Relevance of the topic. Chronic rhinosinusitis (SRB) is a public health problem with significant socioeconomic impact. Furthermore, the complexity of this disease due to its heterogeneous nature based on its underlying pathophysiology leads to the development of different disease variants further complicating our understanding and directions for optimal targeted treatment strategies. There are a number of international/national guidelines, position papers and/or consensus documents that provide current knowledge and treatment strategies for SRS. There are also many problems associated with SRS treatment, especially in severe and resistant forms of the disease. Therefore, the International Collaboration on Asthma, Allergy and Immunology (iCAALL), a collaboration between EAACI, AAAAI, ACAAI and WAO, decided to propose the International Consensus on Chronic Rhinosinusitis (ICON).

All publications published in recent years use the term "rhinosinusitis" instead of sinusitis. According to recent data, approximately 5-15% of the general population is affected by SRS. The prevalence of physician-diagnosed SRS was 2-4%. Chronic rhinosinusitis (SRS) is less common than its acute form, but it is the most common chronic human affliction. This pathology develops in an average of 5% of the population, in the last 10 years it is observed that the incidence of SRS increased by 2 times. Among those hospitalized in otolaryngology departments, patients with SRS make up 25-30%, and this figure increases by 1-2% on average every year. SRS affects approximately 12-15.2% of the US adult population each year. Symptoms of the disease significantly reduce the quality of life of patients. CRS is common, 4.5-12% in the general population, and a subgroup of patients with nasal polyposis in population-based studies accounts for 0.5-4.3%, also in western countries, male gender, older youth and it can be observed that it is common among asthmatics.

CRS is usually further classified based on the presence or absence of nasal polyps (CRS without nasal polyps, CRSsNP, or CRS with nasal polyps, CRSwNP). Although mucopurulent drainage and nasal congestion are common to both, physicians have traditionally divided SRS phenotypically into disease with polyps (CRSwNP) or disease without polyps (CRSsNP). But the presence or absence of polyps does not determine the true pathophysiology of any disease. Although it is clear that chronic inflammation is the cause of these conditions, no theory can explain the etiology of this chronic inflammatory process.



Chronic rhinosinusitis (SRS) remains the most common and painful clinical syndrome characterized by persistent inflammation of the nasal cavity and paranasal sinuses, leading to nasal obstruction, rhinorrhea, facial pain, and anosmia. SRS is usually classified based on the presence or absence of nasal polyps on endoscopy or visualization according to the latest AAO-HNS recommendations. SRS is the most common disease, with a prevalence of 4.5-12% of the general population, and a subgroup of patients with nasal polyposis found in population-based studies is 0.5-4.3%. In Western countries, it is most common among men, the elderly, and asthmatics.

According to EPOS 2020 (The European Position Paper on Rhinosinusitis and Nasal Polyps — the European position paper on rhinosinusitis and nasal polyps), the prevalence of SRS is on average 15.5%. The large amount of data can be related to the design of the study, the age of the patients, and the location of the study. SRS is a serious problem for human health and affects the quality of life of patients due to deterioration of their general condition and limitation of daily activities. Due to the large socio-economic losses, this problem is considered urgent for the healthcare system of many countries.

Today, SRS is considered a multifactorial disease, changes in the microbiota, imbalance of the immune system, allergens, toxins, genetic predisposition can be the cause. Thanks to the improvement of diagnostic methods (in particular, sequencing technologies), in the last decade it became clear that microorganisms play a key role in the occurrence and spread of inflammation in SRS, so they have become one of the urgent problems in otorhinolaryngology.

Diseases of the paranasal sinuses (BYoB) are the most common pathology in otorhinolaryngology, and the modern environmental situation, the widespread spread of allergic and viral diseases, and a decrease in local and general immunity contribute to its development. Many researchers believe that the incidence of chronic rhinosinusitis (SRS), including chronic polyposis rhinosinusitis (SPRS), has increased worldwide in recent years. SPRS occurs mostly in patients older than 30 years. A number of scientists emphasize that men get sick more than women. Among ENT patients, 5% have SPRS.

In SRS, symptoms of the disease persist up to 3 months, and X-ray changes persist up to 4 months after treatment, even in the absence of signs of acute inflammation.

The purpose of the study is to develop a comparative approach to the diagnosis and treatment of different phenotypes of chronic rhinosinusitis, taking into account the state of the nasal cavity microbiome.

Material and methods. We monitored 183 patients with chronic rhinosinusitis aged 18 to 70 years. Among them: 22 patients with chronic rhinosinusitis with polyps, 140 patients without polyps, 21 patients had chronic rhinosinusitis on the background of allergies. In addition, 20 healthy individuals aged 22-55 years, similar in gender and age, who had no allergic and chronic conditions in their anamnesis and had no symptoms of acute respiratory diseases of the nose for 6 months, were examined.

The work was performed in the otorhinolaryngology department of the ADTI clinic and in the otorhinolaryngology department of the TTA multidisciplinary clinic.

In our work, we used the WHO age classification.

Research results. The total number of patients with chronic rhinosinusitis without polyps (SRSVP) was 140, and their chronic diseases were described as follows.

Among the nosological forms of SRS in 1 group of patients, exudative 75 (53.5%) types of chronic rhinitis, 35 (25%) purulent inflammatory diseases of the paranasal sinuses, and 14 (10%) cystic sinusitis constituted the majority. It has been shown that the nosological types of this condition are widespread and that this condition is almost identical to the results of other investigations.

It should be noted that one of the main factors causing the recurrence of chronic rhinosinusitis is a violation of nasal ventilation and a chronic violation of nasal drainage.

Nasal septum curvature in 59 (34.9%) patients, vasomotor rhinitis in 11 (6.5%) patients, chronic hypertrophic rhinitis - 82 (48.5%), hypertrophy of lower nasal cells - 10 (5.9%)) was recorded in the patient. More than 75 patients with exudative serous chronic rhinosinusitis, 48 sinusitis, 12 right-sided, 10 left-sided, 12 bilateral, and 14 cystic patients.

In 1 group of patients under our observation, complaints of patients were studied according to the SNOT scale and the following results were obtained

As can be seen from the table above, when the complaints of patients with chronic rhinosinusitis without polyps are evaluated according to the SNOT scale, nasal congestion is moderate in 70 patients, severe nasal congestion in 68 patients, mild nasal discharge in 11 patients, severe nasal discharge in 81 patients, severe nasal discharge in 48 patients, odor decreased cognition - mild in 30 patients, difficulty breathing - mild in 2, moderate in 70, severe in 68, cough in 10 patients, facial pain in all patients, and fever in 39 patients.



In the studied patients with SRS, from comorbidities, comorbid foci of chronic infection (CIO') are common, which creates conditions for the development of both infectious susceptibility and secondary structural and/or functional immunodeficiency.

In order to determine the functional state of the mucous membrane of the nasal cavity in 1 group of patients with SRS, mucociliary transport, rN, separation, absorption and olfactory functions were examined and compared with the parameters of the control group of practically healthy individuals.

Determination of mucociliary transport function was performed in 140 patients with SRS/P by standard saccharin test. To compare the results obtained, 20 healthy volunteers without diseases of the nose and paranasal cavities were taken. In healthy people, after placing a piece of saccharin, the time until the appearance of a sweet taste in the oral cavity was 5-14 minutes.

The activity of mucociliary transport of the mucous membrane of the nasal cavity was studied in 1 group of patients, it was 22.0 minutes on average and showed that it increased by 191.3%, i.e. 2 times, compared to the parameters of practically healthy individuals in the control group. It cannot be denied that pathological changes in the anatomical structures of the nasal cavity also affect the indicators of the obtained results.

In chronic polypleth rhinosinusitis, rN averaged 7.8 ± 0.01 . The obtained data indicate that the concentration of rN hydrogen ions in the mucous membrane of the nasal cavity has changed in patients with chronic rhinosinusitis. In addition, it is characteristic that pN shifts to the alkaline side.

Pupil reaction time in chronic rhinosinusitis is on average 80.3 ± 4.0 minutes. The obtained results indicate that the absorption function of the mucous membrane of the nasal cavity is impaired in patients with chronic sinusitis.

After examination of patients with SRS, the average weight of the ball was 55.7 ± 0.8 mg. Research shows that in patients with SRS, the transport function of the mucous membrane of the nasal cavity is disturbed, the rN changes, the absorption function is prolonged, and the secretory activity increases due to the increase in the secretion function. In patients with chronic sinusitis, the excretory function index or secretory activity of the mucous membrane of the nasal cavity increases. This means that hyperproduction of mucus and goblet cells has a role, which affects the function of the dividing epithelium and lysozyme activity, which significantly provides the protective composition of nasal mucus.

The analysis of the literature and the results of our study showed that the transport function of the mucous membrane of the nasal cavity is reduced in the presence of a pathology accompanied by a respiratory disorder of the nasal cavity during a significant period of the disease.

It is known that the climate of our republic has a negative effect on the functional state of the mucous membrane of the upper and lower respiratory tract. Taking this into account, we had to choose the least traumatic, acceptable method of surgical treatment. In this, we were helped by the inspection of mukotsiliar transport.

During the rhinoendoscopy examination, most of the patients of the 1st group had reddening of the mucous membranes of the nasal cavity, swelling, enlargement of the nasal concha, redness, narrowing of the nasal passages (obviously observed in patients with chronic hypertrophic rhinitis), the presence of mucus, muco-purulent secretions in the nasal passages, curvature of the nasal septum, hook-like tumor. hypertrophy, bullous enlargement of the middle nasal concha, synechiae after surgery in the nasal passages (in 3 patients), the presence of white spots on the nasal concha (observed in the majority of patients of 3 groups) and polypous formations were detected (in 2 groups of patients).

During the endoscopy of the nasal cavity, various abnormalities were detected in the nasal passages.

Thus, endoscopy of the nasal cavity provides an opportunity to diagnose and treat SRS, is of great importance in identifying the source of infection, and also plays an important role in correcting medical and surgical treatment methods in these cases.

X-rays of the paranasal sinuses were performed in 140 patients with chronic lesions of the paranasal sinuses and maxillary sinuses.

In the X-ray examination of patients with catarrhal form of chronic sinusitis, in 75 cases, a uniform decrease in the transparency of sinus cavities was detected, in 36 cases - intensively, and in 24 cases - sharp shading was detected.

In X-rays of 56 patients with chronic purulent sinusitis, 20 patients - uneven, 24 - uniform, 5 - intense, 7 - border decrease in the transparency of the sinus cavities.

In the vasomotor-allergic form of sinusitis, x-rays showed a decrease in the transparency of the sinus cavity in 9 cases - intensively, in 10 cases - unevenly, in 6 cases - even, in 4 cases - a coastal decrease, and in 1 case, no change in pneumatization was detected.

And in the form of polyposis of chronic sinusitis, X-rays showed irregular semicircular formations with uneven clear edges on the background of pneumatization of the cavity and changed mucous membrane. The shade of polyps was usually numerous, not very large in size. If the inflammatory process ended with the appearance of fluid, it was not possible to identify polyps in the pictures.



Conclusions:

1. The "gold standard" in the diagnosis of rhinosinusitis is the detection of pathogenic and conditionally pathogenic bacteria in high concentrations (> 105 KOE/ml). The largest proportion of the entire mucosal microbiota in CRS consists of Staphylococcus bacteria. This allows to determine the microbiome of the nasal cavity, as well as factors and markers in the formation of biofilms located on the mucosa of the nasal cavity in chronic bacterial rhinosinusitis, which may indicate the phenotypic characteristics of CRS.
2. The obtained results prove the importance of microbial flora in the formation of neutrophilic forms of polyps and justify the selective recommendation of broad-spectrum antibacterial agents to patients of this group.
3. Clinical and microbiological characteristics of patients with CRS were determined based on the analysis of comprehensive clinical-laboratory, microbiological and pathomorphological examination results. The microbiocenosis of the nasal cavity is characterized by dysbiotic disorders of the composition of the microflora species and its pathogenic properties, and is interrelated with the degree and form of damage to the respiratory tract.
4. Taking into account the interrelationship between inflammation and tumor formation in SRS, we can assume that allergy, as a chronic inflammatory disease, may have an indirect effect on the pathogenesis of SRS by regulating the remodeling process in the nasal mucosa, and may cause the occurrence of polyps and the recurrence of the disease.

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