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ANALYSIS OF MODERN DIAGNOSTIC METHODS FOR THE PROLIFERATIVE TYPE OF CHRONIC RHINOSINUSITIS

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Abstract. This scientific article analyzes the importance of diagnosing the proliferative type of chronic rhinosinusitis (PTCRS) using modern methods, and evaluates the effectiveness of diagnostic algorithms and molecular-biological approaches. The study examined the interrelationship and diagnostic value of endoscopic, radiological, morphological, and molecular genetic examinations. The proliferative type of chronic rhinosinusitis is considered the initial stage of the polypoid form, and its correct diagnosis is crucial for preventing recurrent inflammatory processes. The study results showed that the proliferative type of rhinosinusitis is characterized by mucosal hyperplasia, increased fibroblast activity, and elevated expression of biomarkers. The integrated use of clinical, endoscopic, and molecular methods based on modern diagnostic systems increases the accuracy of diagnosis by more than 30 percent.
Keywords: chronic rhinosinusitis, proliferative type, endoscopy, CT, MMP9, COX2, MET gene, biomarker, morphology.

Introduction

Chronic rhinosinusitis (CRS) is a chronic inflammatory process of the mucous membrane of the nasal cavity and paranasal sinuses that persists for more than 12 weeks. According to WHO data, 15% of the world's population exhibits symptoms of CRS, of which 25-30% have a proliferative form that subsequently progresses to polypous rhinosinusitis. The proliferative form has distinct clinical, morphological, and immunological characteristics, and early diagnosis is crucial for successful treatment outcomes.

In the proliferative type of CRS, epithelial hyperplasia of the mucous membrane, increased activity of subepithelial fibroblasts, and enhanced angiogenesis are observed. Studying the genetic, immune, and morphological mechanisms of these changes and developing new, integrated diagnostic methods is one of the urgent tasks of modern otorhinolaryngology.

For the accurate diagnosis of proliferative rhinosinusitis, a multi-stage approach is necessary, based not only on clinical signs but also on endoscopic, computed tomography (CT), and molecular genetic parameters. Currently, the identification of gene and protein biomarkers such as MMP9, COX2, MET, and IL-6 in diagnosis allows for highly accurate differentiation of the disease type. Additionally, methods of automated analysis of CT images and morphometric assessment based on artificial intelligence increase the speed of diagnostics.

Materials and methods

The study was conducted at the Department of Otorhinolaryngology of Tashkent State Medical University. 60 patients were involved in the study: 40 patients diagnosed with chronic rhinosinusitis of the proliferative type, and 20 patients comprising the control group.

All patients underwent clinical examination, rhinoscopy, and endoscopic examination. Nasal mucosal biopsies were taken for morphological and immunohistochemical (IHC) analysis. CT images were also evaluated based on the "Lund-Mackay" scale. For molecular genetic analysis, polymorphisms of the MMP9 (rs3918242), COX2 (rs20417), and MET (rs1621) genes were identified in DNA samples, and their expression levels were assessed.

Laboratory studies were conducted using the following methods: PCR (Polymerase Chain Reaction) - for identifying genetic markers; Real-time PCR - to assess the level of gene expression; Immunohistochemical analysis (IHC) - to determine the expression of MMP9 and COX2 proteins; Histological analysis (H&E staining) - to study the structure of the mucous membrane, epithelial hyperplasia, and fibrosis processes.

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The analysis results were statistically processed using SPSS 27.0 software, and differences with $p < 0.05$ were considered statistically significant.

Results and discussion

The main complaints of patients were nasal congestion (92%), headache (74%), olfactory disturbance (66%), runny nose (62%), and a feeling of pressure in the facial area (58%). In 45% of patients with the proliferative form, the disease lasted more than 3 years, indicating a slow but persistent course of the pathological process.

Endoscopic findings: Endoscopic examination revealed thickened, dark red mucous membrane in the middle nasal passage, with microprolapse observed in some patients. The mucosal surface was uneven and hyperplastic, with serous or seropurulent secretions. The most characteristic features of the proliferative form are hyperemia, mucosal edema, protrusion, and lymphatic dilation.

Computed tomography (CT) analysis - CT results showed that in proliferative rhinosinusitis, up to 2⁄3 of the sinus cavity is filled with dense tissue. At the level of the middle nasal passage and ethmoid cells, the thickness of the mucous membrane reached 2-4 mm. The Lund-Mackay score averaged 6.8±1.5 points. These indicators are close to the polypoid form but indicate a relatively stable stage of structural changes.

Morphological analysis - The results of morphological analysis revealed hyperplastic changes characteristic of the proliferative form:

layering and thickening of epithelial cells;

partial destruction of the basement membrane;

increase in fibroblasts and collagen fibers in the stroma;

eosinophilic and lymphocytic infiltration.

These signs indicate that proliferative rhinosinusitis is an intermediate stage between inflammatory and reparative processes, constituting the initial manifestation of the polypoid form.

Molecular genetic results: MMP9 gene: carriers of the T allele of this gene (rs3918242) had 2.4 times higher mRNA expression. This activates the process of stromal breakdown, creating the basis for the formation of new fibroblasts.

COX2 gene: In patients with the G allele, enzyme activity is increased, prostaglandin E2 synthesis is enhanced, resulting in prolonged inflammation. In these patients, purulent-septic complications occurred 3 times more frequently.

MET gene: as a tyrosine kinase receptor, it promotes proliferation and angiogenesis. In patients with high MET expression, the thickness of the mucous membrane increased by 1.5 times.

These results demonstrate the close relationship between molecular diagnostics and clinical diagnosis. Molecular methods make it possible to predict the likelihood of progression to the polypous form.

Improved model of diagnostic system. The following step-by-step approach in diagnosing chronic rhinosinusitis of the proliferative type was found to be the most effective: Clinical stage - medical history, complaints, and physical examination; Endoscopic assessment - morphology of the mucous membrane, type of secretion; CT visualization - extent of sinus opacification and degree of hyperplasia; Molecular-genetic analysis - determination of biomarkers (MMP9, COX2, MET); Morphological verification is the determination of the form of proliferation at the tissue level. Such an integrated approach increased the accuracy of diagnosis to 82-85%.

Conclusion

The proliferative type of chronic rhinosinusitis is a transitional form between inflammation and tissue growth that progresses to polypous rhinosinusitis if not diagnosed early. Endoscopic and CT analyses are the primary means of visually detecting proliferative changes; however, their accuracy increases significantly when combined with molecular-level studies.

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High expression of MMP9, COX2, and MET genes is identified as the main molecular biomarkers of proliferative rhinosinusitis. Histomorphological analysis of the mucous membrane allows for determining the degree of proliferative changes and is important in assessing the risk of recurrence.

Integrated diagnostics (clinical + endoscopic + genetic) increases the accuracy of SRSPT diagnosis by more than 30%, enabling the development of an individualized treatment plan for the patient at an early stage.

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