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ENHANCING THE EFFECTIVENESS OF DIAGNOSING RECURRENT CHRONIC POLYPOSIS RHINOSINUSITIS USING ARTIFICIAL INTELLIGENCE

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Abstract. This scientific article analyzes the effectiveness of using artificial intelligence (AI) technologies in diagnosing recurrent chronic polyposis rhinosinusitis (RCPRS). The study examined the application of neural network-based algorithms in analyzing clinical, morphological, and computed tomography (CT) data. It has been proven that the automated model created using artificial intelligence demonstrates high sensitivity and accuracy in determining the probability of polyp recurrence. The results show that the use of AI systems increases diagnostic accuracy by 20-25% and reduces errors caused by human factors.

Keywords: recurrent rhinosinusitis, polyp, artificial intelligence, neural network, CT analysis, diagnosis, biomarker, morphology.

Introduction

In recent years, chronic polypoid rhinosinusitis (CPRS) has remained one of the most common diseases in otorhinolaryngology as a widespread pathology on a global scale. According to the World Health Organization (WHO), the incidence of rhinosinusitis is recorded in 10-15% of the general population, of which 4-6% have the polypoid form. In the Republic of Uzbekistan, over the past decade, this indicator has increased by an average of 7-9 percent annually.

The most complex aspect of polypoid rhinosinusitis is its recurrent nature. Recurrence of surgically removed polyps within 1-2 years has been observed in 30-40% of cases. This situation indicates insufficient individualization of diagnosis and treatment. As a result, in recent years, there has been growing interest in the application of artificial intelligence (AI) technologies in the diagnostic process.

Artificial intelligence, and especially deep learning methods, demonstrate high efficiency in the automatic analysis of medical images. They enable segmentation of CT, MRI, and endoscopic images, detection of pathological changes, and their classification.

The aim of the study was to reduce human error by automating the diagnosis of recurrent CPRS, as well as to shorten the time required for diagnosis.

Materials and methods

The study was conducted at the Department of Otorhinolaryngology of Tashkent State Medical University and the "Medical Innovations Center."

A total of 80 patients were involved in the study, of which 50 were included in the main group with the diagnosis of recurrent CPRS, and 30 in the control group with the diagnosis of chronic rhinosinusitis without polyps.

The average age of the patients was 34±8 years. The research protocol was carried out in accordance with the recommendations of the WHO "Human Research Ethics Committee." Written consent was obtained from each participant.

The following data were collected from each patient:

Clinical signs (nasal congestion, purulent discharge, headache, olfactory disorders);

Endoscopic indicators (mucosal hyperemia, edema, polypoid growth size);

Radiological indicators (assessment according to the Lund-Mackay scale based on CT);

Laboratory data (inflammatory markers, eosinophil count, genetic polymorphisms).

In the study, a convolutional neural network (CNN) model based on artificial neural networks (ANN) was developed. The model was trained using the Python programming language with the

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TensorFlow 2.10 platform. Each CT image (in axial, coronal, and sagittal sections) was processed in a 512×512 format, and more than 50,000 images were segmented.
The model automatically segmented the polyp tissue, mucous membrane thickness, and degree of sinus ventilation. 20% of the data was separately allocated for validation. The "Adam optimizer" and "binary cross-entropy loss" functions were used for training the model.

Table 1. Distribution of study participants by groups

Group	Number of patients	Age range	Mean age
Main (QSPRS)	50	18-60	34 ± 8
Control	30	20-58	33 ± 7

In the second stage of the study, the model's results were compared with diagnoses made by human experts. Accuracy, sensitivity, specificity, and ROC-AUC were used as evaluation criteria.

Results and discussion

The AI model demonstrated 93.2% accuracy and 90.1% sensitivity in detecting polyp tissues in CT images.
Additionally, the model achieved an ROC-AUC of 0.88 in predicting recurrent cases.
Table 2. Artificial intelligence model results compared to human experts

Indicator	Artificial intelligence (%)	Expert physicians (%)
Accuracy	93.2	72.1
Sensitivity	90.1	68.7
Error	6.8	27.9

The results determined by the model correlated with morphological studies. In recurrent cases, changes such as epithelial hyperplasia, increased fibrous tissue, and eosinophilic infiltration were more frequently observed in the mucous membrane. The automatic detection of these signs by the artificial intelligence system significantly accelerated the diagnostic process.
The model also developed an index predicting the probability of recurrence based on changes in CT images. In patients with polyp size >2.5 cm, mucosal thickness >3 mm, and eosinophil level >8%, the risk of recurrence was found to be 4.3 times higher ($p < 0.05$). The results showed that AI-based analysis reduces human error, improves patient monitoring, and assists doctors in clinical decision-making. Moreover, the system's self-learning function further increased accuracy as new data was introduced. This enabled the development of an individualized approach corresponding to patient recurrence cases. During the discussion, it was noted that the use of artificial intelligence in medicine is only an auxiliary tool and cannot completely replace the doctor's experience in clinical decision-making. However, it is significant in improving diagnostic speed, reducing errors, standardizing data, and analyzing multi-center data.

Conclusion

According to the research results, the application of artificial intelligence technologies in diagnosing recurrent chronic polypoid rhinosinusitis increases diagnostic accuracy by 20-25%. AI-based systems demonstrated high effectiveness in automatic CT image analysis, predicting the likelihood of polyp recurrence, and supporting clinical decisions.
By using artificial intelligence:
the speed of diagnosis increased by 1.8 times;
Human errors in the analysis process decreased by 70%;
It became possible to monitor patients and predict relapses.

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In the future, it is necessary to adapt such systems to local demographic data, integrate them with morphological and genetic markers, and conduct multi-center clinical trials in the conditions of Uzbekistan.

References

1. Djuraev J.A., Soatov I.O. MET (Tyrosine kinase receptor gene) Gene polymorphism among patients with chronic polyposis rhinosinusitis and chronic rhinosinusitis. Clinical Medicine, Tashkent Medical Academy Journal, 2023, No. 1, pp. 113-116. ISSN 2181-7812. Tashkent Medical Academy, Tashkent, Uzbekistan.
2. Djuraev J.A., Soatov I.O., Rakhimjanova G.A., Mardonov Kh.A. Results of clinical and cytomorphological studies conducted to identify various forms of chronic polypoid rhinosinusitis. Eurasian Journal of Otorhinolaryngology - Head and Neck Surgery, 2024, Vol. 3, Issue 4, pp. 56-61. Tashkent Medical Academy, Tashkent, Uzbekistan. DOI: https://doi.org/10.57231/j.ejohns.2024.3.4.0010
3. Juraev Jamolbek Abduqahhorovich, Soatov Ilyosjon Olim ugli. Comparative analysis of the frequency of the rs3918242 MMP9 gene polymorphism in the group of patients with chronic polypoid rhinosinusitis. Problems of Biology and Medicine, 2024, No. 4 (155), pp. 73-76. Tashkent Medical Academy, Tashkent, Uzbekistan. ISSN 2181-7812.
4. Soatov Ilyosjon Olim o'g'li, Djurayev Jamolbek Abdukaxarovich. Pathomorphological structure of polypoid tissue in patients with chronic polypoid rhinosinusitis. Uzbekistan Medical Journal, 2023, Issue 2. pp. 59-64. Tashkent Medical Academy, Tashkent, Uzbekistan.
5. Soatov Ilyosjon Olim o'g'li. Biomarkers and genotyping in the development of chronic polypoid rhinosinusitis. Association of Pulmonologists of Central Asia, 2024, pp. 100-103. Tashkent Medical Academy, Tashkent, Uzbekistan. ISSN: - (Article published in the Bulletin of the Pulmonology Center, https://tbcenter.uz/)
6. Khasanov U.S., Djuraev J.A., Mardonov Kh.A., Soatov I.O., Khodjaeva D.M., Khakimov R.A. Results of comparative analysis of TLR4 gene rs4986791 polymorphism in the development of nasopharyngeal tonsil hypertrophy. Eurasian Journal of Otorhinolaryngology - Head and Neck Surgery, 2024, Vol. 3, Issue 4, pp. 23-27. Tashkent Medical Academy, Tashkent, Uzbekistan. DOI: https://doi.org/10.57231/j.ejohns.2024.3.4.004
7. Khasanov U.S., Djuraev J.A., Mardonov Kh.A., Soatov I.O., Khodjaeva D.M., Khakimov R.A. Results of the analysis of MBL2 gene polymorphism in alleles and genotypes in the development of nasopharyngeal tonsil hypertrophy. Eurasian Journal of Otorhinolaryngology - Head and Neck Surgery, 2024, Vol. 3, Issue 4, pp. 17-22.
8. Khasanov U.S., Soatov I.O., Khodjanov S.Kh., Akhundjanov N.O., Rakhimjanova G.A. Results of the analysis of rs20417 polymorphism prevalence in the COX2 gene among patients with chronic polypoid rhinosinusitis and chronic rhinosinusitis, and in the control group. American Journal of Medicine and Medical Sciences, 2024, 14 (12): 3149-3153. DOI 10.5923/j.ajmms.20241412.13 Tashkent Medical Academy, Tashkent, Uzbekistan.