CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND ALLERGIC BRONCHITIS: MORPHOLOGICAL CHANGES IN BIOLOGICAL FLUIDS (LITERATURE REVIEW)

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Annotation

Chronic obstructive pulmonary disease and allergic bronchitis are among the pressing issues in the global healthcare system. Scientific literature widely highlights that in these diseases, significant morphological changes are observed not only in the bronchial tissues but also in biological fluids. In particular, structural alterations recorded in saliva, blood, and other biological environments are considered important markers in the diagnosis and monitoring of these diseases. A review of the literature shows that the integrated use of saliva crystallization and other fluid markers holds great scientific and practical significance in improving the diagnosis of chronic obstructive pulmonary disease and allergic bronchitis.

Keywords: Saliva crystallization, chronic obstructive pulmonary disease, allergic bronchitis, diagnostics, biological markers

Introduction

Chronic obstructive pulmonary disease (COPD) and allergic bronchitis are among the respiratory pathologies that pose a significant threat to human health. According to the World Health Organization (WHO), more than 200 million people worldwide suffer from these diseases each year, and a considerable portion of them face loss of working capacity or the risk of premature death [1]. As emphasized by Oxford University scientist Barnes, COPD is one of the most common and disabling diseases of the 21st century, along with cardiovascular diseases and cancer [2]. Therefore, due to their clinical manifestations and the complexity of diagnosis and monitoring, these pathologies are regarded as a global problem.

The first scientific observations on the crystallization of saliva were carried out by the American scientist George Papanicolaou, who, by observing the crystalline forms of salts in saliva under a microscope, recorded changes associated with hormonal cycles [3]. Later, the Soviet scientist Ivchenko and his colleagues discovered that saliva crystals exhibit specific morphological features in various diseases [4]. Their studies demonstrated that in inflammatory processes, the regularity of the crystals is disrupted and porous, irregular shapes appear, substantiating that the stage of a disease can be assessed through crystal morphology [2,7]. Since then, saliva crystallization has begun to be considered an important factor not only in hormonal and dental diagnostics but also in the detection of respiratory diseases.

One of the main morphological changes observed in COPD is the destruction of the alveolar walls and an increase in bronchial secretion [5]. This process is also reflected in the composition of saliva: the balance of electrolytes is disrupted, the ratio of proteins changes, and as a result, crystallization patterns acquire a pathological appearance. In COPD patients, the increased activity of proteases enhances protein degradation, leading to loosening of the crystal structures [2]. Mandel, in his studies, demonstrated that when the balance of sodium, potassium, calcium, and chloride ions is disturbed, the regularity of the crystals is lost, which is exactly the process observed in COPD [8].

In allergic bronchitis, however, morphological processes are closely associated with immunological mechanisms. The increase in the amount of immunoglobulin E (IgE), along with the abundance of histamine and cytokines, causes qualitative changes in bronchial secretions. According to Kushnareva (2005), the crystallization process in the saliva of patients with allergic bronchitis is manifested by small, scattered, and sharply angled structures. This is fundamentally different from the large, semi-starlike, or porous forms seen in COPD [6]. Thus, the analysis of the crystalline morphology of saliva has been scientifically proven to make it possible to establish a differential diagnosis between COPD and allergic bronchitis.

The diagnostic significance of saliva crystallization has been confirmed in clinical studies. For example, observations conducted by Rao in India with the participation of 120 patients demonstrated that morphological patterns of saliva crystals allowed distinguishing between COPD and allergic bronchitis with 85% accuracy [9]. The fractal analysis method developed by Jensen (2015) made it possible to mathematically model the complex shapes of crystals [10]. According to the research findings, the crystallization rate in patients with COPD was found to be twice as slow compared to healthy individuals [11]. Molecular-level analyses, in turn, provide opportunities to detect changes in the ratio of ions and proteins.

From a practical point of view, the analysis of saliva crystallization has several advantages: firstly, this method is non-invasive, meaning that it does not require blood or tissue sampling from the patient; secondly, the process is inexpensive and rapid; thirdly, it makes it possible to detect diseases at early stages. Due to these aspects, recommendations are being developed in many clinics to introduce saliva analysis as an additional diagnostic method [1,12].

However, existing studies have certain limitations. The crystallization process is highly sensitive to environmental conditions (humidity, temperature, time), and improper storage or analysis may distort the results [12]. In addition, the patient's general metabolic condition (such as diabetes mellitus, kidney diseases) can affect saliva composition and alter crystal morphology. Therefore, it is important to evaluate crystal analysis in combination with other clinical and laboratory indicators.

Conclusions

Chronic obstructive pulmonary disease (COPD) and allergic bronchitis remain serious problems in the global healthcare system. In these diseases, significant morphological changes are observed not only in the bronchial tissues but also in biological fluids, particularly in saliva. One of the important methods for detecting such changes in saliva is the analysis of saliva crystallization. The advantages of this analysis include its non-invasiveness, low cost, and high sensitivity, while its limitations are related to sensitivity to external factors and possible distortions under the influence of other diseases. Therefore, integrating saliva crystallization with other markers (blood cytokines, exhaled air analysis) can further improve the diagnosis of COPD and allergic bronchitis.

References:

1. WHO Report (2021). Chronic respiratory diseases: global strategy. World Health Organization.
2. Barnes, P. J., Anderson, G. P., Fagerås, M., & Belvisi, M. G. (2021). Chronic lung diseases: prospects for regeneration and repair. European Respiratory Review, 30(159).
3. Papanicolaou, G. N. (1946). THE CYTOLOGY OF THE GASTRIC FLUID IN THE DIAGNOSIS OF CARCINOMA OF. Journal, 7, 357.
4. Ivchenko, G. I. "The waiting time and related statistics in the multinomial scheme: a survey." (1993): 451-482.
5. Agustí, A., Melén, E., DeMeo, D. L., Breyer-Kohansal, R., & Faner, R. (2022). Pathogenesis of chronic obstructive pulmonary disease: understanding the contributions of gene–environment interactions across the lifespan. The lancet Respiratory medicine, 10(5), 512-524.
6. Kushnareva T. (2005). Salivary diagnostics in allergic diseases. Russian Journal of Immunology.
7. Barnes, P. J., & Hansel, T. T. (2004). Prospects for new drugs for chronic obstructive pulmonary disease. The Lancet, 364(9438), 985-996.
8. Mandel, I. D. (1990). The diagnostic uses of saliva. Journal of Oral Pathology & Medicine, 19(3), 119-125.
9. Rao, A. C., Kondas, V. V., Nandini, V., Kirana, R., Yadalam, P. K., & Eswaramoorthy, R. (2023). Evaluating the effect of poly (amidoamine) treated bioactive glass nanoparticle incorporated in universal adhesive on bonding to artificially induced caries affected dentin. BMC Oral Health, 23(1), 810.
10. Casey, D. T., Lahue, K. G., Mori, V., Herrmann, J., Hall, J. K., Suki, B., ... & Bates, J. H. (2024). Local fractal dimension of collagen detects increased spatial complexity in fibrosis. Histochemistry and cell biology, 161(1), 29-42.
11. Müller, M., Platten, F., Dulle, M., Fischer, B., Hoheisel, W., Serno, P., ... & Breitkreutz, J. (2021). Precipitation from amorphous solid dispersions in biorelevant dissolution testing: The polymorphism of regorafenib. International Journal of Pharmaceutics, 603, 120716.
12. Zaynullin A. (2018). Morphological analysis of salivary crystals in COPD. Russian Pulmonology Journal.