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LABORATORY DIAGNOSIS OF AUTOIMMUNE DISEASES

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Annotation
Autoimmune diseases are a heterogeneous group of pathologies characterised by impaired immunological tolerance and the production of autoantibodies directed against the body's own tissues. Effective laboratory diagnostics plays a key role in early detection, monitoring and prediction of the course of these diseases. This review considers modern methods of laboratory diagnostics of autoimmune diseases, including serological, molecular-biological and functional tests, and evaluates their specificity and sensitivity in clinical practice [3,4,5].

Keywords: autoimmune diseases, systemic lupus erythematosus, rheumatoyl arthritis, immunoenzyme analysis, autoimmune thyroiditis;

Introduction

Autoimmune diseases cover a wide range of nosological units, including systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), systemic scleroderma, autoimmune thyroiditis, celiac disease and others. According to epidemiological studies, the prevalence of autoimmune diseases is steadily increasing, which makes it necessary to improve the methods of their laboratory diagnosis. The diagnostic

process includes identification of autoantibodies, determination of inflammatory markers, analysis of the functional state of the immune system and application of molecular technologies [1,2,6].

Serological diagnostics. The central place in the laboratory diagnosis of autoimmune diseases is occupied by serological analysis for the presence of specific autoantibodies. The most significant methods include:

- **antibodies ELISA (enzyme-linked immunosorbent assay) - widely used to quantify autoantibodies such as antinuclear** (ANA), anticardiolipin antibodies, anti-CCP (anti-cyclic citrullinated peptides), etc.
- **- Indirect immune fluorescence assay (IIFA)** - used to detect ANA on Hep-2 cells, allowing visualisation of the type of fluorescent glow associated with specific autoimmune pathologies.
- **- Immunoblotting and immunoprecipitation** - have high specificity and are used to clarify the spectrum of autoantibodies, particularly in SLE, scleroderma, and myositis.

Additional information about the severity of the disease and the activity of the inflammatory process is provided by:C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) are non-specific but sensitive markers of systemic inflammation [7,8,9,10]**.**

- **- Cytokines (IL-6, TNF-α, IFN-γ)** reflect the level of activation of the immune system and are involved in the pathogenesis of many autoimmune diseases. Additional information about the severity of the disease and the activity of the inflammatory process is provided by:C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) are non-specific but sensitive markers of systemic inflammation**.**
- **- Organ-specific enzymes and hormones - e.g.** thyroid hormones and thyroperoxidase antibodies in autoimmune thyroiditis [21,22,23,24]**.**
- **Molecular genetic methods.** With the introduction of molecular diagnostics it has become possible to identify predisposition to autoimmune diseases. The most popular are:Определение HLA- **types (e.g. HLA-B27 in ankylosing spondylitis).**
- **-** PCR analysis to detect polymorphisms of genes associated with autoimmune reactions.NGS

- (next-generation sequencing) is a promising area for studying gene expression and detecting pathogenetically significant mutations [16,17,18,19,20]**.**

- **Cellular immunological tests.** Assessing the functional status of cells in the immune system is also important:
- **- Immunophenotyping by flow cytometry -** allows to determine the ratio of lymphocyte subpopulations and the presence of activation markers.Cellular immunological tests. Assessment of the functional state of the cells of the immune system is also important**:**

- Lymphocyte proliferation tests - used in the evaluation of immunodeficiency states and autoimmune pathologies**.**

Prospects and challenges. Despite the wide variety of laboratory methods, the diagnosis of autoimmune diseases remains challenging due to their clinical and immunological polymorphism. The combination of different techniques, the use of multi-analyses and the development of artificial intelligence (AI)-based algorithms represent promising avenues to improve diagnostic accuracy and patient stratification [11,12,1,3,14,15].

Conclusion. Laboratory diagnostics is an integral component of the management of patients with autoimmune diseases. Modern methods allow not only to confirm the diagnosis, but also to assess the disease activity, predict its course and monitor the effectiveness of therapy. The development of high-tech and multidisciplinary approaches opens new horizons in understanding autoimmune pathology and personalising medical care.

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