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FEATURES OF THE IMMUNOPHYSIOLOGY OF THE CHILD'S BODY AGED 10–18 YEARS

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Abstract

The immune system of children and adolescents is characterized by dynamic development, reflecting the body's growth and hormonal changes. Between the ages of 10 and 18, significant changes occur in the functioning of the innate and adaptive immune systems, influencing susceptibility to infections, the formation of immunological memory, and the development of immune responses. This paper examines age-related characteristics of immunophysiology, analyzes the immune system in 110 adolescent patients, and identifies key patterns of its functioning.

Keywords: immunophysiology, children, adolescents, immune system, age-related characteristics, immunity, development

Introduction

The immune system plays a key role in maintaining the body's homeostasis and protecting against infectious agents. During childhood, it is actively developing, which determines its functional characteristics. The period from 10 to 18 years is a transitional stage from childhood to adulthood, accompanied by hormonal changes, accelerated growth, and the restructuring of physiological systems.

The adolescent immune system is characterized by instability of its regulatory mechanisms, which can manifest itself as both increased susceptibility to infections and a tendency toward hyperreactivity (allergic and autoimmune reactions). Studying immunophysiological characteristics at this age is important for disease prevention and optimization of medical care.

Study Objective

To study the immunophysiological characteristics of children and adolescents aged 10 to 18 years and to identify characteristic changes in the immune system during this age period.

Study Materials and Methods (110 Patients)

The study was conducted from 2024 to 2026 at an outpatient clinic. The study included 110 patients aged 10 to 18 years. All subjects were divided into two age groups: the first group consisted of 55 young adolescents (10–13 years old), and the second group consisted of 55 older adolescents (14–18 years old). The groups were comparable in terms of gender: 52 boys (47.3%) and 58 girls (52.7%).

Inclusion criteria included age between 10 and 18 years, absence of acute infectious diseases at the time of examination, and absence of severe chronic pathologies, including autoimmune diseases, oncological diseases, and congenital immunodeficiency conditions. Informed consent

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from parents or legal guardians was mandatory. Patients with acute inflammatory processes, exacerbations of chronic diseases, and those taking immunomodulatory drugs within the past three months were excluded from the study.

All participants were examined under standard conditions in the morning (8:00 AM to 10:00 AM) on an empty stomach, which minimized the impact of external factors on immune system parameters. Venous blood was collected observing all aseptic and antiseptic precautions.

The clinical examination included a medical history, assessing the frequency of previous infectious diseases, the presence of allergies and chronic pathologies, and a physical examination to determine the general condition.

Laboratory diagnostics included a complete blood count (CBC) to determine the white blood cell count, lymphocyte and neutrophil percentages, and the erythrocyte sedimentation rate. For a more detailed assessment of the immune system, an immunological study (immunogram) was performed, including determination of T-lymphocyte (CD3+), T-helper (CD4+), T-suppressor (CD8+), B-lymphocyte (CD19+), and natural killer cell populations. Humoral immunity was assessed by determining the concentration of IgA, IgM, and IgG immunoglobulins using an enzyme-linked immunosorbent assay.

Statistical processing of the obtained data was performed using standard methods of variation statistics. Mean values and standard deviations were calculated, and a comparative analysis between groups was performed using the Student's t-test. Differences were considered statistically significant at a significance level of $p < 0.05$.

Methods

The following methods were used to assess the immune system:

- complete blood count
- leukocyte and lymphocyte count
- immunogram (T- and B-lymphocyte assessment)
- immunoglobulin levels (IgA, IgM, IgG)
- statistical data processing

Results of the Study

Analysis of the obtained data revealed the following characteristics:

1. Cellular Immunity

Children aged 10–13 years showed a relative immaturity of the T-lymphocyte component, manifested by reduced functional activity. In the 14–18-year-old group, an increase in the number of mature T-lymphocytes and increased activity were observed.

2. Humoral Immunity

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Immunoglobulin levels gradually increased with age. The most pronounced changes were observed for IgG, indicating the formation of immunological memory.

3. Influence of Hormonal Changes

In the older age group, a link was found between sex hormone levels and immune system activity. During puberty, instability of immune parameters was observed.

4. Body Reactivity

Adolescents in the older group more often demonstrated hyperreactive immune responses, including allergic reactions.

Discussion

These results confirm that the age range from 10 to 18 years is a critical period for the development of the immune system. The immaturity of immune mechanisms in younger adolescents results in increased susceptibility to infections. Meanwhile, older adolescents experience enhanced immune responses, which can lead to the development of allergic and autoimmune conditions.

Hormonal changes associated with puberty play a significant role. Sex hormones modulate the immune system, altering the balance between its various components.

Thus, the adolescent immune system is characterized by high plasticity but also by functional instability.

Conclusion

The study revealed that the immunophysiology of children aged 10 to 18 years is characterized by marked dynamism and depends on the stages of age-related development, including growth and puberty. During this age period, the immune system is not completely stable but continues to develop, which affects both the cellular and humoral components of immunity.

In young adolescents (10–13 years), the immune system exhibits relative functional immaturity, manifested by reduced T-lymphocyte activity and an ineffective immune response. This leads to increased susceptibility to infectious diseases and less stable immunological reactivity. At the same time, immunological memory is actively developing in this age group, which is an important stage in the development of adaptive immunity.

In older adolescents (14–18 years), increased functional activity of the immune system is observed, including an increase in the number and differentiation of T- and B-lymphocytes, as well as an increase in immunoglobulin levels, particularly IgG. However, due to hormonal changes associated with puberty, the immune system is characterized by a certain instability, which can manifest as an increase in immune responses, including the development of allergic and autoimmune conditions.

The influence of the endocrine system on the immunity of adolescents is particularly significant. Sex hormones modulate immune processes, altering the balance between cellular and humoral immunity. This confirms the close relationship between the body's physiological systems during the period of active development.

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Thus, the immune system of children and adolescents aged 10–18 years is functionally active, but not yet fully stabilized, and is sensitive to external and internal influences. The obtained results emphasize the need for an individualized approach to assessing immune status in this age group, as well as the importance of timely prevention of infectious and immunopathological conditions.

The practical significance of this study lies in the potential use of the obtained data to improve preventive measures, develop age-specific monitoring and health promotion programs for children and adolescents, and enhance the effectiveness of medical care in pediatric practice.

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