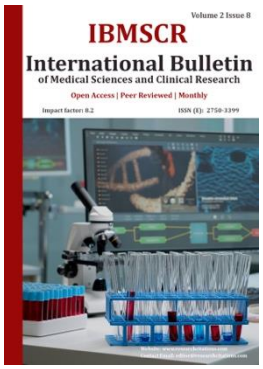

CARDIOVASCULAR AND IMMUNE SYSTEM CHANGES IN CHILDREN WITH LYMPHATIC-HYPOPLASTIC DIATHESIS

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Abstract.

Lymphatic hypoplastic diathesis (LDH) is one of the constitutional and anatomical anomalies found in children, characterized by hyperplasia of lymphatic tissues, immunological dysfunction and high susceptibility to infectious and allergic diseases. In this case, an increase in the thymus, lymph nodes and adenoid tissues, a violation of the humoral and cellular immune response are observed. Patients may experience respiratory infections, allergic reactions and functional cardiovascular changes - sinus tachycardia, bradycardia and extrasystoles. Cardiac arrhythmias are mainly associated with vegetative dysfunction and a dysimmune state, and are not associated with organic pathologies of the heart. Lymphatic hypoplastic diathesis is one of the urgent problems that need to be studied in clinical pediatrics, pediatric immunology and cardiology, and its early diagnosis and comprehensive control are of great importance in ensuring resistance to infections and preventing complications. Purpose. To study immunological dysfunction, constitutional-anatomical anomalies and cardiovascular changes in children with LDH and to assess the possibilities of preventing complications through early detection and monitoring of this condition. Methods. The study was conducted on 30 patients with LGD aged 5-12 years and 35 healthy children. The CD4/CD8 ratio was determined by flow cytometry. Statistical analysis was performed using Microsoft Office Excel-2016 and SPSS 26 using t-test, x2 and Pearson correlation. Results In the group of patients with LDH, frequent infectious diseases (70%), allergic (40%) and lymphoid tissue hyperplasia (33%), sinus tachycardia (46.7%), sinus arrhythmia (40%), changes in the PQ interval (30%) and repolarization (26.7%) were detected on ECG ($p<0.05$). Immunological analyses showed a low CD4/CD8 lymphocyte ratio, which was significantly different from the control group ($p<0.05$). Conclusion. Children with lymphatic hypoplastic diathesis have immunological and autonomic dysfunction and lymphoid tissue hyperplasia. These conditions cause functional changes in the cardiovascular system, which over time can lead to the development of irreversible organic pathologies. Therefore, early diagnosis and comprehensive monitoring of patients with LGD is of great importance in reducing the complications of infectious, allergic, and cardiovascular diseases.

Key words: lymphatic hypoplastic diathesis, lymphoid hyperplasia, immunological dysfunction, infectious diseases, heart rhythm disorders.

Introduction.

Lymphatic hypoplastic diathesis (LHD) is one of the most common constitutional and anatomical conditions in pediatrics, characterized mainly by persistent and generalized hyperplasia of lymphatic tissues, especially the thymus and peripheral lymph nodes. This condition usually occurs without obvious signs of infection and is most common in children aged 2–7 years, and the clinical course is the same in both sexes [1-3]. In its pathogenesis,

imbalances in the endocrine and immune systems play a leading role. In particular, insufficiency of the pituitary-adrenal axis and the predominance of mineralocorticoids lead to a decrease in the humoral and cellular immune response. As a result, children lose their adaptability to environmental influences and become prone to frequent infectious diseases, allergic reactions, and chronic respiratory diseases [4,5]. Clinically, children with LGD are characterized by such features as pale skin, marbled skin color, a tendency to chronic edema, lethargy, hypotonia, excess adipose tissue, and developmental delay. At the same time, adenoid hyperplasia, enlarged tonsils, and thymomegaly are detected during radiological and clinical examinations[6-8]. LGD is not an independent disease, but a constitutional anomaly. However, its clinical significance is determined by its immunological consequences and the complexity of the diagnosis. It is especially important to differentiate LGD-associated thymomegaly from pathological lymphadenopathy or tuberculosis of the internal thoracic lymph nodes [9]. As noted in the literature, imbalance in the autonomic nervous system, impaired neuroendocrine coordination, and metabolic disorders in children with LGD are also reflected in the cardiovascular system [10]. In particular, electrocardiographic studies show that patients with LGD have sinus tachycardia, rhythm lability, small changes in myocardial repolarization processes, and a decrease in the functional reserve of the heart [10]. In addition, changes in heart rhythm against the background of lymphoid-hypoplastic syndrome are associated with an increased susceptibility of the body to infections and stress responses, which increases the risk of developing arrhythmias, functional cardiomyopathy, and cardiac hypertrophy in children [10-14]. Therefore, the clinical and theoretical significance of lymphatic-hypoplastic diathesis is determined not only by changes in the immune and endocrine systems, but also by functional disorders in the cardiovascular system. Studies in this direction are important for a deeper understanding of pathogenetic mechanisms and the development of targeted preventive measures.

The aim of this study is to study immunological dysfunction, constitutional-anatomical anomalies, and functional changes in the cardiovascular system in children with LGD, and to assess the possibilities of preventing infectious, allergic, and cardiovascular complications that may arise through early detection and comprehensive monitoring of this condition.

Materials and methods

This study was conducted in 2024-2025 in the Andijan Regional Children's Multidisciplinary Medical Center, 30 patients with Lymphatic Hypoplastic Diathesis and 35 healthy children of the same age, who were treated for various diseases in the Cardiology, Pulmonology, Nephrology, Urology departments, were recruited from 3-12 years old.

All participants had anthropometric indicators, somatic status, lymphoid tissue status, laboratory tests: general blood test, immunological indicators (lymphocytes, CD4/CD8 ratio) determined by flow cytometry. Instrumental examination methods - Electrocardiography (ECG), rhythm, heart rate, repolarization processes, signs of arrhythmia were assessed on a 12-lead standard ECG device. Echocardiography: heart pump function, heart muscle condition and signs of myocardial hypertrophy were examined.

Statistical analysis was performed using Microsoft Office Excel-2016 and SPSS 26. Values were expressed as mean ± standard deviation. Comparison of differences between qualitative indicators was performed using Pearson's $\chi 2$ test, and for quantitative indicators with a normal distribution, using Student's t-test. Differences with a level of $P<0.05$ were considered statistically significant.

Results.

The clinical manifestations of 30 children with LGD who participated in the study were analyzed and compared with the control group (35 healthy children). 70% of patients with LGD had frequent upper respiratory tract infections, 40% had allergic diseases (atopy, skin rashes), and 33% had lymphoid tissue hyperplasia (adenoid vegetations, tonsillar hypertrophy) (Fig. 1).

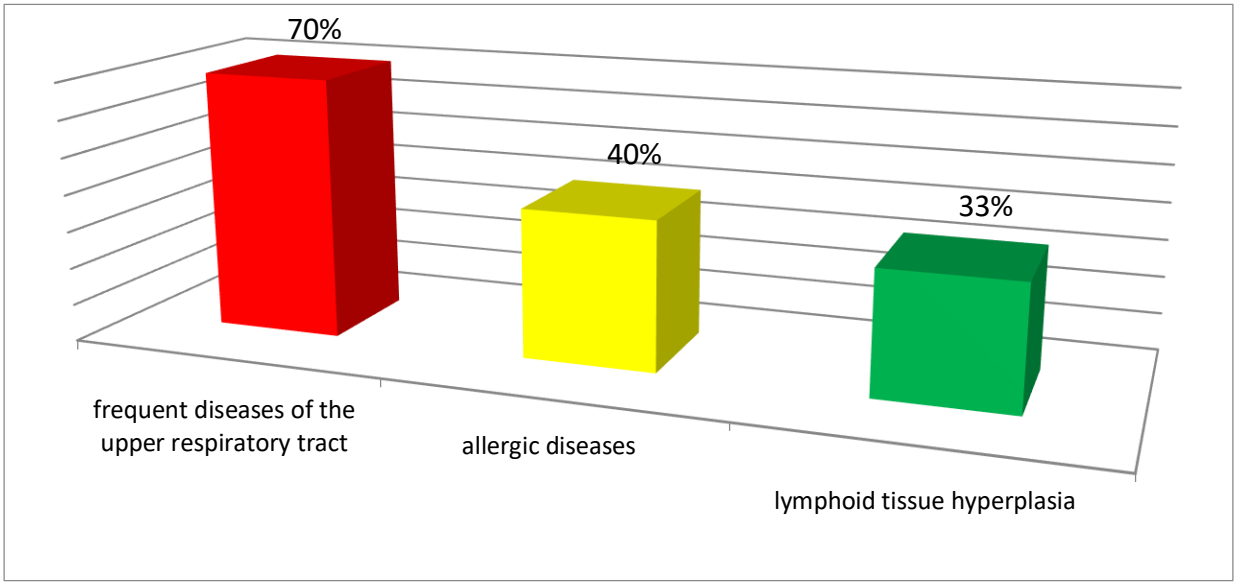

Figure 1. Clinical signs observed in patients with lymphatic hypoplastic diathesis (n=30).

ECG examination was performed to determine heart rate, rhythm repolarization processes and signs of arrhythmia in the group of LDH patients and healthy children (Table 1).

Table 1. Changes in heart rate and repolarization in children with lymphatic hypoplastic diathesis and the control group (n=65).

Indicators	**LGD group (n=30)**	**Control group (n=35)**	**p-significance**
Sinus Tachycardia (%)	46,7%	11,1%	$p < 0.05$
Sinus Arrhythmia (%)	40,0%	16,6%	$p < 0.05$
Lability of PQ interval (%)	30,0%	5,5%	$p < 0.05$
ST-segment and T-wave repolarization changes (%)	26,7%	0,0%	$p < 0.001$

Heart rate (mean ± SD, min^{-1})	96,3 ± 8,4	84,2 ± 6,7	p < 0.01

Although echocardiographic examination of patients with LGD showed that systolic cardiac function was largely preserved, mild abnormalities in diastolic myocardial relaxation were noted in 20% of patients. No cases of cardiac hypertrophy were observed (Table 2).

Table 2. Echocardiographic examination results in children in the study (n=65).

Echocardiography parameters	**LGD group (n=30)**	**Control group (n=35)**	**p-significance**
Systolic function (EF, %, etc.)	saved	Saved	n.s(no differen-ce)
Diastolic relaxation disorder (%)	20,0%	0,0%	p < 0.001
Cardiac hypertrophy	not observed	not observed	-

Immunological parameters. Patients with LGD had a higher lymphocyte count (42.5±3.1%), and a lower CD4/CD8 ratio (1.1±0.2), which was significantly different from the control group (p<0.05).

Discussion.

The results of the conducted study showed that children with lymphatic hypoplastic diathesis (LHD) have a number of functional changes in the heart rhythm and circulatory system. In particular, ECG analysis showed that sinus tachycardia, rhythm lability, and minor disturbances in repolarization processes were significantly more common in patients with LHD than in healthy children[10,11]. In our study, the high HR and PQ interval lability in the main group indicate an imbalance in the autonomic control of the heart. In addition, minor repolarization changes in the ST segment and T wave indicate the presence of functional electrical abnormalities in the myocardium[10-14]. Echocardiographic data showed that the pumping function of the heart was mainly preserved, but mild disturbances in diastolic relaxation of the myocardium were detected in 20% of patients. This condition may be associated with chronic hypoxia and autonomic dysfunction in the heart tissues[10-12].

Immunological analyses showed a decrease in lymphocytosis and CD4/CD8 ratio. This indicates a high susceptibility of the body to infections and a dysfunctional stress response. As noted in the literature (Ivanov, 2018; Petrova, 2020), LGD is accompanied by malfunctions in the immune system, which may be accompanied by functional disorders in the cardiovascular system[2-4,8].

Conclusion.

1. Functional changes in the cardiovascular system were detected in children with lymphatic-hypoplastic diathesis, which were manifested in the form of sinus tachycardia (46.7%), arrhythmias (40.0%), PQ interval lability (30.0%) and repolarization disorders (26.7%) ($p<0.05$).

2. Echocardiographic analyses showed mild disorders in diastolic relaxation of the myocardium in 20% of patients, while the pump function was largely preserved.

3. Immunological parameters showed a decrease in lymphocytosis and the CD4/CD8 ratio, which indicates a predisposition to infections and a weakening of immune control.

4. The data obtained indicate the need for regular monitoring of heart rhythm and electrophysiological status in children with LGD, ECG screening examinations, and the introduction of early preventive measures.

Authors' contribution.

Concept and idea: Muqaddas Boltaboeva

Data preparation and collection: Abdulfaizhon Muhammadkhanov

Formal analysis: Muqaddas Boltaboeva

Study management: Abdulfaizhon Muhammadkhanov

Methodology: Lola Rakhmanova

Project supervision: Lola Rakhmanova

Writing the first version of the text: Muqaddas Boltaboeva

Ethical committee approval.

Ethical informed consent for the participation of children in the study was obtained from their parents in accordance with the requirements of the Geneva (Helsinki) Declaration. Ethical permission for this study was granted by the Ethics Committee of the Andijan State Medical Institute (Permit number: 2/60, date: 10.03.2024).

Conflict of interest.

The authors declare that there are no conflicts of interest in the preparation and publication of this article.

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