International Journal of Formal Education
Volume: 01 Issue: 08 | August – 2022 ISSN: 2720-6874
http://journals.academiczone.net/index.php/ijfe

Correlation Relationship of Immunological and Thyroid Parameters in Congenital Heart Diseases in Children

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Abstract

Background: Congenital heart disease (CHD) includes structural abnormalities of the heart that occur before birth and such defects occur in the fetus when it develops during pregnancy. According to WHO, congenital heart disease occurs in 1% of newborns, regardless of the level of medicine in the country . Approximately 500,000 adults in the United States suffer from congenital heart defects. 1 in 100 children have heart defects due to genetic or chromosomal abnormalities.

Keywords: Thyroid, Heart, Diseases, Children.

Natural mortality in all congenital heart diseases is about 40%, with most patients dying in the first year of life, and 70% of them in the first month of life. In the age structure of mortality from CHD and anomalies in the development of the great vessels, 91% are children of the first year of life.

In the world, special attention is paid to scientific research aimed at studying the causes of congenital malformations in children, early diagnosis based on immunogenetic studies and improving methods of treatment and their prevention. At the same time, the determination of changes in biochemical and immunological parameters, mediators of an acute inflammatory process, hormonal parameters, early diagnosis and development of surgical treatment methods, the use of new immunomodulatory drugs in treatment and the improvement of rehabilitation measures for congenital heart defects are becoming an urgent direction of scientific research.

The study of the effect of hormones of the endocrine glands on the reactivity of the body is one of the urgent problems of modern medicine. Mean while, the materials accumulated in the literature on the study of the effect of thyroid hormones on the immune system have not yet received the necessary analytical comprehension, although their influence on the reactivity of the body is of great interest. It has been shown that the lack of thyroid hormones leads to a sharp drop in the complementary activity of the blood, a decrease in the level of properdin and lysozyme, an increase in the number of circulating immune complexes, and a decrease in phagocytic activity.

The study of interrelations may help to explain the situations of immune balance in the presence of a quantitative deficiency of certain indicators, as well as obvious defects in immune defense in the physiological correspondence of the levels of immunocompetent cells and immunoglobulins.

In connection with the presented data, one of the unresolved and important problems in pediatric cardiac surgery, pediatrics and pediatric surgery remains to reduce the mortality rate from CHD in young children and improve the prognosis for recovery in children. Thus, the issue of improving the provision of medical care to children with CHD remains relevant and requires scientific research in this direction.

The aim of the work is to assess the course of CHD in children with the study of the immune and hormonal status.

Materials and methods: The studies were carried out on the basis of the Bukhara Regional Children's Multidisciplinary Medical Center. We examined 60 sick children with congenital heart disease, whose mothers had excluded immunological and endocrine diseases. The control group consisted of 30 healthy children.

All patients underwent clinical, immunological, biochemical, laboratory and functional (DoECHOCG, ECG, radiography) studies. All children underwent immunological and hormonal studies.

Immunological studies of the blood of sick children were carried out in the laboratory of immunomorphology of the Institute of Immunology and Human Genomics of the Republic of Uzbekistan. The indicators of cellular and humoral immunity were studied.

To determine the main populations of human lymphocytes, monoclonal antibodies of the LT series were used, developed at the Institute of Immunology of the Ministry of Health of the Russian Federation, SPC "Sorbent" (Moscow) using the method of indirect rosette formation.

The content of immunoglobulins was determined by the method of radial immunodiffusion according to Manchini using monospecific sera against immunoglobulins G, A and M, produced by the Moscow Institute of Microbiology and Epidemiology. N.F.Gamalei. The level of immunoglobulins of each test sample was determined from the calibration curve and expressed in mg%.

Blood tests of sick children with congenital heart diseases for thyroid (T3, T4, TSH) status were carried out in the laboratory of the diagnostic center of the city of Bukhara by enzyme immunoassay on the device STATFAX 303 (USA, 2010) using a standard set of reagents JSC VECTOR-BEST (ISO international certificates 9001 and ISO 13485, Russia).

We carried out a correlation analysis between immunological and endocrine blood parameters in CHD in children. Correlation analysis was carried out using Pearson's (r) methods. The most reliably significant immunological parameters were selected for correlation analysis.

Results and their discussion: In CHD in children, a direct average relationship of T-lymphocytes with free T3 (r=0.512) was established. Inverse weak relationship exists between T-lymphocytes and free T4 (r=-0.288) (Fig. 1). At the same time, with a decrease in the acquired immune response, an imbalance of thyroid hormones in the blood is observed. The main action of free T4 is to enhance catabolism, that is, the acceleration of processes that occur with the release of energy from the body's reserves. Consequently, a decrease in the level of T-lymphocytes compensatory increases the concentration of free T4, while the tissue energy demand is covered by increased catabolism.

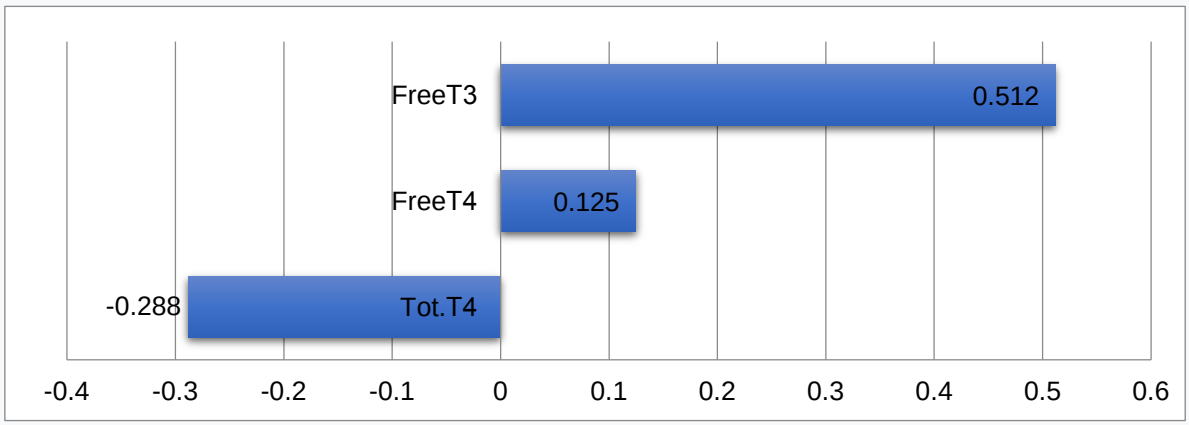

Figure 1. Correlation dependence of T-lymphocytes with the levels of thyroid hormones in the blood

Analysis of other subpopulations of lymphocytes showed a decrease in T-helpers and the presence of a direct average relationship with total T3 (r=0.590), free T4 (r=0.524) and an inverse relationship with free T3 (r=-0.472) (Fig. 2.).

It is known that the T3 hormone is responsible for metabolic processes in the body, so its deficiency will contribute to frequent illnesses, a decrease in the protective functions of the body, and the inability of tissues to recover from injuries. Free T3 is involved in oxygen metabolism and its uptake by cells. Therefore, it can be concluded that in children with CHD, a decrease in the helper function of cellular immunity is accompanied by an increase in the need of tissue cells for oxygen, while a compensatory increase in the level of free T3 in the blood is observed.

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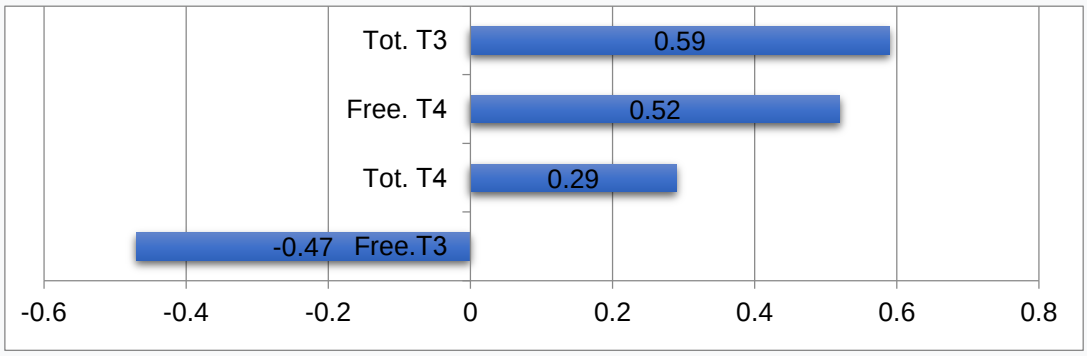

Figure 2. Dependence of the level of T-helpers on the concentration of blood hormones

In our studies, a direct weak relationship was established between T-suppressors and the concentrations of total T3 (r=0.282) and total T4 (r=0.396) in the blood of patients with congenital heart disease. The average inverse relationship is noted between T-suppressors with free T3 (r = -0.681). All this proves the physiological relationship of the hypothalamic-pituitary-thyroid system, which are involved in the pathogenesis and determine the course of CHD (Fig. 3).

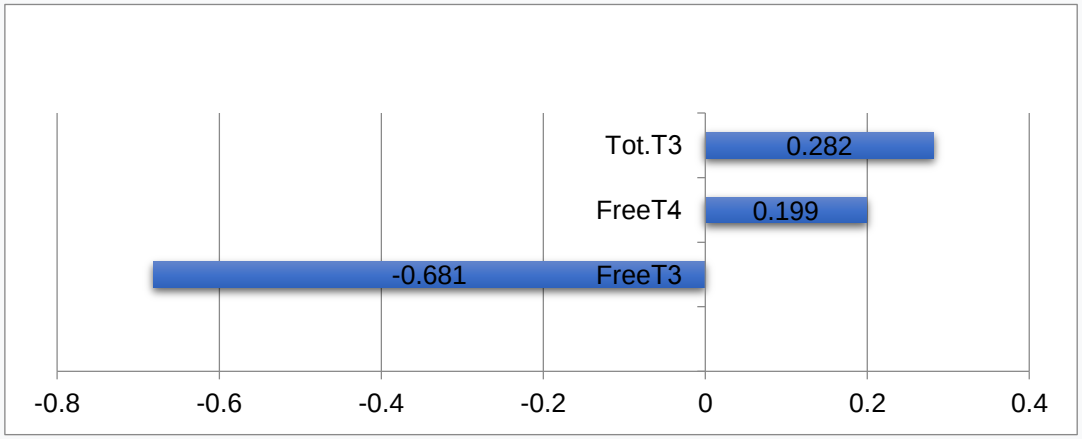

Figure 3. Correlating relationship between the level of T-suppressors and thyroid hormones in the blood

Therefore, an increase in the level of T-suppressors is accompanied by thyroid dysfunction.

T-killers, cytotoxic T-lymphocytes, are a type of T-lymphocytes that lyse damaged cells of their own body. Targets of T-killers are cells affected by intracellular parasites (which include viruses and some types of bacteria), tumor cells. T-killers are the main component of antiviral immunity.

In our studies, a significantly high content of T-killers in children with congenital heart disease was noted, which inversely correlated with a reduced level of free T4 (r=-0.430), light T3 (r=-0.338) (Fig. 4.).

Figure 4. Correlation of T-killers with blood hormones

The high content of T-killers in the blood in CHD indicates the presence of cells with virus-specific antigens infected with the virus. Consequently, in CHD, the antiviral immune response is aimed at enhancing cytotoxic reactions, which is realized by suppressing the processes of energy release from the body's reserves and oxygen metabolism.

CD20 lymphocytes are humoral immune cells that are involved in the synthesis of antibodies and are formed in the bone marrow. The peripheral blood contains about a fifth of these cells, the bulk is in the peripheral lymphoid organs.

The high content of CD20 cells in children with CHD was directly related to the indicators of total T3 (r=0.348), and is inversely related to the content of both total T4 (r=-0.376) and free T4 (r=-0.235). However, this condition of thyroid dysfunction had a weak relationship. The absence of a relationship between CD20 cells and free T3 in the blood was found (r=0.029).

It was found that immunoregulatory index (IRI) in children with CHD directly correlated with the concentrations of total T3 (r=0.456) and free T4 (r=0.449), which confirms the reliability of the results obtained on the relationship of T-helpers with thyroid hormones. In the humoral status of children with CHD, correlations were noted only with the level of IgM and sv. T4 (r=0.441).

However, it should be borne in mind that in patients with immunodeficiency, the formation of immune memory is disrupted, and therefore there may be cases when, with repeated infection with the same pathogen, the phase of predominant IgM production takes place again.

It is established that there is a connection of IgM with the level of free T4 in CHD. Consequently, the increase in the acute process of antibody formation is accompanied by an acceleration of the processes of energy release from the body's reserves due to increased catabolism.

Conclusion: Thus, the analysis of the relationship revealed the presence of a high degree of integration (the number of statistically significant links) of immunological and hormonal indicators included in the correlation structure, which reveals the mechanisms of internal regulation of immunity and the hormonal system in children with CHD.

The maximum strength and number of correlational interactions reflect a high degree of functional stress of the immune system against the background of an imbalance of hormonal indicators.

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