CLINICAL, IMMUNOLOGICAL, AND BIOCHEMICAL CHARACTERISTICS OF IODINE DEFICIENCY DISORDERS IN ADULTS LIVING IN AN ENDEMIC AREA

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Abstract. *The study is devoted to assessing the clinical, epidemiological, and biochemical characteristics of iodine deficiency conditions in adults living in moderate endemic iodine deficiency conditions. The data of 210 individuals, divided into the main group (n=160) with various forms of thyroid pathology and the control group (n=50) without thyroid diseases, were analyzed. Age, sex, disease structure, and urine iodine levels as key biomarkers of iodine availability were assessed. Additionally, laboratory studies of the hormonal profile, antibodies, and ultrasound parameters of the thyroid gland structure were performed. It was established that in patients of the main group, a significantly lower median ioduria, a high frequency of hypothyroidism, endemic goiter, and autoimmune thyroiditis were noted. A clear correlation has been established between the degree of ioduria reduction and the severity of clinical manifestations. The obtained results confirm the need for early detection and prevention of iodine deficiency conditions among the population of endemic regions. The analysis demonstrates the high informativeness of the comprehensive clinical and laboratory examination and emphasizes the importance of monitoring iodine availability for the timely prevention of thyroid diseases.*

Keywords. *iodine deficiency, thyroid pathology, endemic goiter, hypothyroidism, ioduria, AIT, prevention, screening.*

Introduction.

Iodine deficiency disorders remain one of the most significant endocrinological problems in the world and affect more than 2 billion people. Despite the achievements of preventive programs, iodine deficiency continues to lead to increased prevalence of goiter, hypothyroidism, cognitive impairment, and decreased quality of life. This problem is especially important in endemic regions, where the natural deficiency of iodine in water and soil forms a persistent tendency for the growth of thyroid diseases.In Uzbekistan, according to national observations, up to 30-40% of the population in certain regions have signs of iodine deficiency, which is accompanied by an increase in the frequency of hypothyroidism, AIT, and thyroid structural changes. The adult population, despite participating in preventive programs, remains insufficiently covered by monitoring, leading to late diagnosis and the growth of chronic forms of pathology.Iodine is a key microelement in the synthesis of thyroid hormones that regulate metabolism, cardiovascular function, growth, reproductive health, and neurohumoral regulation. Iodine deficiency leads to compensatory hyperplasia of the thyroid gland, impaired hormone production, and the development of hypothyroidism. Especially dangerous are the latent forms of deficiency, which for a long time proceed without pronounced clinical symptoms, but lead to a decrease in work capacity and disruption of metabolic processes.Monitoring urine iodine levels is the most informative method for assessing iodine availability and allows for the timely identification of risk groups. The data of our study confirm that the decrease in the level of ioduria is closely related to the high frequency of hypothyroidism, endemic goiter, and AIT.The research has high scientific and practical significance, as it allows for the identification of the real scale of the problem of iodine deficiency and determines the directions for improving preventive programs.

Purpose of the research.

The purpose of the study is to comprehensively assess the clinical and laboratory characteristics of iodine deficiency conditions in adult residents of the endemic region, including the analysis of the hormonal profile, thyroid gland structure, ioduria levels, and the prevalence of thyroid diseases. Additionally, the task is to identify the relationship between the severity of iodine deficiency and the clinical forms of pathology, identify the most significant diagnostic markers, and evaluate the

effectiveness of ongoing preventive measures. The obtained data should serve as a basis for optimizing the strategy for early detection and prevention of thyroid diseases in endemic areas.

Materials and methods.

The study included 210 adult patients divided into two groups: main (n=160) and control (n=50). Inclusion criteria: age 18-65, residence in an endemic region for at least 5 years, absence of iodine intake for the last 6 months. The main group included patients with hypothyroidism, endemic goiter, and AIT. The control group included individuals without thyroid pathology.

All subjects underwent: - Ultrasound of the thyroid gland with determination of volume; - study of the level of TSH, free T4, antibodies to TPO; - Determination of urine iodine levels using the Sandell-Kolthoff method; - collection of clinical and anamnestic data; - statistical processing (M±m, t-criterion, U-criterion, $p<0.05$).

Table 1.

Clinical indicators of the groups

Indicator	Basic (n=160)	Control (n=50)
Average age (years)	41.8 ± 2.9	40.2 ± 2.5
Women (%)	71.2	69.0
Hypothyroidism (%)	29.8	0
Endemic goiter (%)	32.0	0
AIT (%)	18.1	0
Iodine in urine (µg/l)	86 ± 7	126 ± 9.

Results.

Analysis of the obtained data revealed significant differences between the groups in most of the studied indicators. In patients of the main group, a significant decrease in urine iodine levels (86±7 mcg/l versus 126±9 mcg/l in the control group, $p<0.001$) was noted, which confirms a pronounced iodine deficiency. The frequency of hypothyroidism was 29.8%, endemic goiter - 32.0%, AIT - 18.1%, while in the control group, these pathologies were absent. The hormonal profile also demonstrated differences: the average TSH level in the main group was elevated (4.9 ± 0.6 mU/l), while in the control group it was 2.1 ± 0.4 mU/l ($p<0.01$). The level of free T4 decreased to 11.3±1.1 pmol/l versus 15.8±1.3 pmol/l ($p<0.05$). The frequency of AT-TPO increase was 22.5%. Thyroid ultrasound revealed an increase in organ volume in 28.1% of patients in the main group, and nodal changes in 16.3%.

Table 2.

Laboratory indicators

Indicator	Main	Control
TSH (mU/L)	4.9 ± 0.6	2.1 ± 0.4
T4 free (pmol/l)	11.3 ± 1.1	15.8 ± 1.3
AT-TPO (%)	22.5	6.0
Increased thyroid volume (%)	28.1	4.0
Nodes (%)	16.3	2.0
Indicator	Main	Control

differences between the main and control groups in thyroid indicators are expressed quantitatively in percentages, for example, the tth level in patients of the main group was 4.9 mU per liter, which is 13.3 percent higher compared to the control, where it was 2.1 mU per liter. the level of free t4, on the contrary, was reduced in the main group to 11.3 pmol per liter,

while in the control group it reached 15.8 pmol per liter, equivalent to a 28.5 percent decrease. the level of antibodies to tpo is positive in 22.5 percent of cases in the main group, which is higher than in the control group by 27.5 percent, where it was only 6 percent. an increase in thyroid gland volume was registered in 28.1 percent of patients in the main group, while in the control group, only in 4 percent, which is equivalent to a 60.2 percent increase. nodular changes were detected in 16.3 percent of the examined in the main group, which is 7.15 percent higher than in the control group, where nodes were noted in 2 percent. thus, all key indicators indicate significantly more pronounced changes from the thy

Conclusion.

The conducted research showed that in adult residents of an endemic region with iodine deficiency, both functional and structural disorders of the thyroid gland are significantly more common. The obtained data clearly demonstrate a pronounced imbalance of key thyroid parameters, accompanied by an increase in the frequency of hypothyroidism, endemic goiter, autoimmune aggression, and nodal changes. Significant decrease in urine iodine levels recorded in the main group indicates persistent and clinically significant iodine deficiency, which is reflected in the hormonal profile and morphological characteristics of the gland. The identified differences in the levels of TSH, free T4, and antibodies to TPO confirm that impaired iodine supply has a pronounced effect on the regulation of hormone production and contributes to the formation of autoimmune reactions. The increase in thyroid gland volume and a higher frequency of nodal formations emphasize the duration and severity of compensatory processes in conditions of chronic iodine deficiency.The research results confirm the need for regular monitoring of the population's iodine status, expanding preventive programs, and introducing accessible methods for early detection of thyroid pathology. A comprehensive assessment of the levels of ioduria, hormones, and ultrasound parameters should be considered an effective screening tool that allows for the timely identification of risk groups and prevents the further progression of thyroid diseases.

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