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Efficiency of adaptation to hypoxic hypoxia in a course of artificial climatetherapy in correction of the hormonal status at thyroid gland hypofunction at children

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Key words: children with hypothyroidism; hormone status; thyroid gland hypofunction; artificial climatetherapy; intermittent hypoxic training.

Abstract. Stimulatory effect of artificial climatetherapy (intermittent hypoxic training) on the function of thyroid gland reveals not in increasing of different hormones during hypoxia only, but the improving of functional respiratory system (FRS) function by itself influences on endocrine system that is a part of

regulatory chain of functional respiratory system by the children with hypothyroidism.

Endocrinology diseases were widely adopted in our country, especially last decade. Actual and especially sharp this problem became owing to failure on Chernobyl PowerStation not only in Ukraine, but also in the near abroad countries – Belarus and Russia which population also has suffered from ionizing radiation influence. Number of the persons has considerably increased in Ukraine, suffering dysfunction of a thyroid gland [1].

Interference of a hormonal condition and maintenance of an organism with oxygen the fact fixed in a science. Endocrinology glands played an essential role in management of a condition of functional system of breath [3]. It is known that maintenance of an organism with oxygen in many respects depends on thyroid gland function, its products intensify a metabolism, raise oxygen consumption, cause a tachycardia, maintenance decrease glycogen in heart [1, 2, 4, 5, 6, 7 and many others].

Dependence oxidative phosphorylation and produce adenosine triphosphate (ATP) - the basic source of biological energy, from speed of stage-by-stage delivery of oxygen in lungs, an alveolus, transport its arterial blood to mitochondria in which oxygen is utilized, has made necessary studying of a fortune of functional system of breath (FSB) and body oxygen regimen (BOR) at persons suffering thyroid gland hypofunction.

Now well-known constructive action of adaptation to hypoxia: substantial improvement of a condition of functional system of breath, its aerobic productivity, increase of stability of an organism to any influences. The first encouraging data about artificial climatetherapy application (intermittent hypoxic training - IHT) in endocrinology [9] is obtained.

In the literary review about action lowered partial pressure of oxygen upon function of a thyroid gland at the healthy persons, the spent prof. A.Z. Kolchinska et al. [3], it is noticed that epithelium of thyroid gland follicles positively react only in the event that hypoxic influences are moderated. If moderate sharp hypoxia causes in plasma of blood increase of the maintenance of the iodine connected with fibers and at short-term hypoxic faltering (7000) in a thyroid gland there are the reorganizations testifying to strengthening of its function at longer and chronic hypoxia oppression of function of a thyroid gland [3] is observed.

The purpose of the work - to reveal efficiency of adaptation to hypoxic hypoxia in a course of artificial climatetherapy (intermittent hypoxic training) in improvement of a condition of functional system of breath, and its role in correction of the hormonal status at thyroid gland hypofunction at children.

Methods and the organization of researches.

35 girls with **chronic lymphocytic thyroiditis** in the hypothyroid condition in easy and average form are surveyed. The characteristic of a contingent of the surveyed is resulted in tab. 1. 25 girls (the first group) received a course of traditional therapy during application artificial climatetherapy (intermittent hypoxic training). 10 girls (the second group) received only traditional therapy, the data of initial and repeated testing spent to the same terms, as in the first group served as the control.

Table 1.

The characteristic of a contingent of the surveyed.

Groups	The Diagnosis	Age	Weight	Growth	Quantity	Notes
1	chronic lymphocytic thyroiditis in the hypothyroid condition	8.3±0.3	38±6	118±5	25	course of traditional therapy during application Artificial climate-therapy (intermittent hypoxic training).
2		8.0±0.5	35±7	116±7	10	control

As appears from medical cards of the surveyed both groups, sick girls with thyroid gland hypofunction received L-tyrosine in a dose of 25-50 mkg daily in the first days after an initiation of treatment. Each 2-4 weeks dose L-tyrosine increased by 12-25 mkg and by the time of carrying out of our researches has made 125-150 mkg a day. Patients showed complaints to the general weakness, fatigue, memory decrease, drowsiness, constraint of movements. The part of patients complained of frequent dizziness, headaches, sensations of the swelled language, the delay of menstruation, heartaches. Complaints of sick both groups and disease terms were similar.

For revealing of reaction of an organism of the girls with hypothyroidism, on inhalation hypoxic mixes it was spent hypoxic test before and after course IHT. To patients has been offered hypoxic test with 12 % of oxygen, such low

content of O_2 in that test has been recommended after well transferred ten-minute hypoxic test with 14 % of oxygen.

Before the IHT course and after its patients was passed the special inspections including survey of the doctor, electrocardiogram registration, ultrasonic, the clinical analysis of contain thyroid hormones (T_3 and T_4) and thyrotropin in venous blood. For definition of physical working capacity, the step-test on Dobelnu (1967) was spent. Research of indicators of a functional condition of an organism, physical working capacity of the girls with hypothyroidism, was spent before and after course IHT against traditional therapy, at parallel definition of the same indicators in control group.

Course IHT for patients with hypothyroidism consisted of 14 sessions. Each session IHT included 4-5 series of five-minute series of breath by a gas mixture with low oxygen content which alternated with same on duration normoxic intervals. Maintenance O2 in hypoxic gas mix depended from degree of adaptation to hypoxic hypoxia, in first five sessions maintenance O2 in the gas mixture was 13 %, in second five - 12.5 %, in third five - 13 % of oxygen. For delivery hypoxic gas mixes the device has been used by firm "Trade Medical" (Russia – Swaziland, manager - T.N. Tsyganova). That device has a gas analyzer on which board in a digital form the information on concentration of oxygen in hypoxic mix.

Methods of mathematical statistics were applied to processing of the received data: criterion of Student's; the analysis of the given tool researches has been spent on IBM PC under the program "Design procedure of oxygen parameters" by A.Z. Kolchinska et al [3].

1. **Results of researches**

As a result of carrying out of 14 sessions of IHT course the general condition of patients has improved: weakness, fast fatigue, drowsiness, headaches, heartaches have disappeared, the mood has improved.

According to the data of clinical inspection it is authentic ($p < 0.05$) the content of thyroid hormones in blood (Fig. 1) has raised.

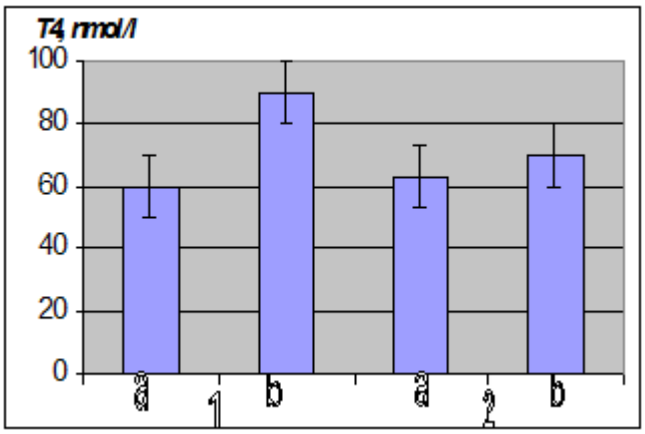

Fig. 1. Content of thyroid hormones change in venous blood before (a) and after (b) IHT course: 1 - patients with hypothyroidism, who received IHT course on an extent traditional therapy; 2 - data of the control group who's received only a course of traditional therapy.

At what, the gain of maintenance of T_4 in whey of blood at half of patients has made 20-58 nmol$*$l^{-1} and has reached normal values – 90,56±8,12 nmol$*$l^{-1}. Maintenance of T_3 has increased on 0.6±0,1 nmol$*$l^{-1} and has averaged 1.8±0.17 nmol*l-1. At two patients it has reached the higher border of norm - 2.61 nmol*l-1. Maintenance of thyroid-stimulating hormone has decreased with

10,8±1,1 мED*l^{-1} to 4,2±0,4 мED*l^{-1} (p <0.05). In control group the similar tendency of change of maintenance TTT in blood, however this decrease also was marked has been less expressed (10,95±2,89 4 мED*l^{-1} – initial testing, 8,27±1,47 4 мED*l^{-1} - repeated testing). In control group the maintenance of thyroid hormones in blood had the weak tendency to the increase, however less expressed, than in group of application IHT against replaceable therapy.

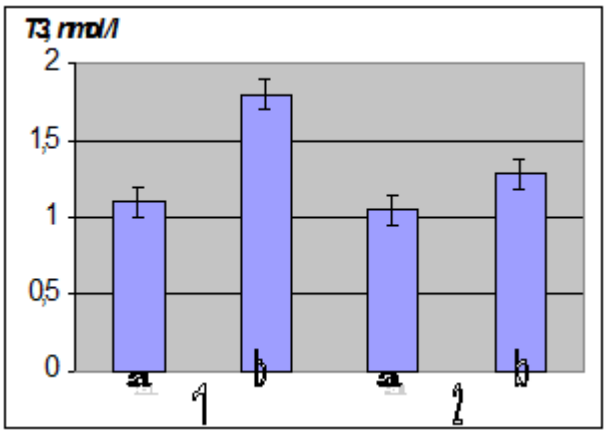

Fig. 2. Content of thyroid hormones change in venous blood before (a) and after (b) IHT course: 1 - patients with hypothyroidism, who received IHT course on an extent traditional therapy; 2 - data of the control group who's received only a course of traditional therapy.

Researches of a condition of functional system of breath (FSB), spent by us in the conditions of the basic exchange, before and after course IHT have shown that authentic changes of parameters of external breath it was not marked. Size of minute volume of blood (MVB), frequencies of breath (FB) and respiratory volume (VO) differed from the initial data doubtfully (p> 0.05), but that has essential value, oxygen consumption has authentically increased with 149,5±4,5 ml*min-1 to course IHT to 173.25±4.3 ml*min-1 after it (p <0.05) whereas in group of the control of similar changes it was not observed.

Heart rate had some tendency to increase though and not authentic (p> 0.05), thus minute volume blood (MVB) and shock volume (УО) practically have not changed (p> 0.05). As a result of adaptation to hypoxia the hemoglobin

maintenance has authentically increased after course IHT ($p < 0.05$). At the part of patients, the hemoglobin gain for 14 days reached to 20 g*l-1.

As a result of increase of the maintenance of hemoglobin in blood oxygen capacity of blood and the quantity of oxygen in arterial blood (CaO_2) the patients who have received course IHT have authentically increased ($p < 0.05$), in group of the control of similar changes has not been noted (tab. 3 see).

All features of function of external breath set forth above, blood circulations, respiratory function of blood have provided some changes of oxygen regimen of an organism at patients with thyroid hypofunction after course IHT in the conditions of the basic exchange.

Speed of receipt of oxygen in lungs and alveolus's remained almost without changes, speed of delivery of oxygen arterial blood to fabrics has authentically increased with 582±11 $ml*min^{-1}$ to 645±13 $ml*min^{-1}$ ($p < 0.05$), thus speed of delivery of oxygen the mixed blue blood has not changed since speed of consumption of oxygen fabrics has considerably increased ($p < 0.05$).

Conditions of recycling of oxygen, at the expense of an oxygen voltage reduction in the mixed blue blood with 40±1 mm hg to 36±1 mm hg and increases thereof arterio-venous gradient O_2 have a little improved. After course IHT of authentic differences of cascades partial pressure of oxygen at patients of control group from the initial data us it was revealed not ($p > 0.05$). Profitability of external breath has authentically increased ($p < 0.05$) that was expressed in increase in oxygen effect of a respiratory cycle: the organism began to receive for one respiratory cycle instead of 5,81±0,01 oxygen ml, 6.66±0.3 ml O_2, each respiratory cycle became more effective concerning supply of fabrics by oxygen. Heart work became more economic also: on each warm cycle of a fabric began to receive instead of 2,25±0,03 ml O_2, 2,88±0,05 ml O_2 as HR in rest has changed doubtfully - with 65,3±3,4 bites/min to 68,3±2,36 bites/min, and consumption by an oxygen organism has increased.

Thus, maintenance increase thyroid hormones as a result of action lowered partial pressure of oxygen in inhaled air leads to improvement of condition FSB. In turn improvement of a condition of links FSB, leads to increase in consumption by an oxygen organism as a whole, and in particular can testify about increase in speed of consumption of oxygen separate bodies and fabrics including increase of consumption of oxygen by a thyroid gland fabric, certainly, causes its intensification secretory activity.

Conclusions

Inhalation of hypoxic gas mixes in an interval mode from 12-13 % of oxygen in persons with hypofunction thyroid glade strengthening of function of a thyroid gland, strengthens production of its hormones, reduces the maintenance of thyroid-stimulated hormone in blood, raises oxygen consumption, increased the hemoglobin maintenance in blood, promoting that liquidations to anemic hypoxia, increases working capacity, reducing the oxygen heart working costs;

Adaptation to hypoxia in the course of interval hypoxic trainings in complex therapy primary thyroid hypofunction has allowed to lower dose L-tyrosine on 30-35 %. That is why, we recommended application adaptation to hypoxia in a course interval hypoxic training in treatment of hypofunction thyroid glade.

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