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Menstrual dysfunction in adolescent girls born with low body weight and its correction according to the conditions of iodine deficiency

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Abstract

On the basis of the performed studies it was determined that the formation of menstrual function in adolescent girls born with low body weight depends on the natural iodine deficiency at the place they live. The proposed therapy, which is aimed at elimination of iodine deficiency, promotes normalization of hypothalamo-pituitary-ovarian system and has a positive effect on menstrual function.

Keywords: adolescent girls, iodine deficiency, menstrual function.

1. Introduction

The problem of preservation and strengthening of the reproductive health of adolescent girls in connection with the increase of babies with low birth weight in particular according to the conditions of iodine supply, has the important medical and social value [2, 3, 4]. Sexual development affects the formation of menstrual function in adolescent girl and directly depends on the functional state of hypothalamo-pituitary-ovarian system [5, 6, 7, 8].

It was determined that in some regions of Ukraine and especially in the region of Transcarpathia the extremely high prevalence of thyroid gland pathology is observed among both the adult population, and among adolescent girls [1, 3, 6]. This condition causes both menstrual and reproductive function violations especially in the mountainous regions of Transcarpathia [1, 3].

Obviously, in-depth study of this problem will ultimately produce a series of preventive measures to improve the reproductive health of adolescent girls born with low body weight according to the conditions of iodine supply.

2. The Aim of Research

The aim of this study is to improve the reproductive health in adolescent girls born with low body weight in the conditions of iodine deficiency.

2.1. Material and Methods

A comprehensive study of 100 adolescent girls born with low body weight in Transcarpathia regions with different levels of natural iodine deficiency was performed.

For comprehensive assessment of sexual development the methods of determining the stages of sexual development of Taner was used taking into account the nature of menstruation, pilosis peculiarities and the breasts development.

Clinical examination included the collection of anamnesis and conversation with the mother of the patient to clarify the status at birth, the living conditions of the girl from birth to the present time. The sequence of secondary sexual characteristics, including the establishment of menstrual function, overall condition before and during menstruation was determined.

Ultrasound examination (USE) was performed transabdominally on the apparatus “Toshiba” model SAL – 38 AS (Japan) with the help of linear transducer with a frequency of 3.5 MHz.

The severity of iodine deficiency was defined in terms of median iodineuria cerous-arsenometric method.

Thyroid gland function was assessed based on the levels of thyroid stimulating hormone (TSH), triiodothyronine (T3), free thyroxine (fT4), which were determined using the kits BAH (Kharkiv).

Levels of tropic pituitary hormones – follicle stimulating (FSH), luteinizing hormone (LH), prolactin (PRL), steroid hormones of the ovaries – estradiol (E2), progesterone (P), were

examined in a laboratory center "SINEVO" during the first and the second phases of the menstrual cycle with the determined menstrual cycle and during any day in nonestablished menstrual cycle.

Therapeutic and preventive measures were primarily directed to the elimination of iodine deficiency, normalization of hormonal function of hypothalamo-pituitary-ovarian system, improvement of microcirculation in the uterus and ovaries.

For this purpose, a combined preparation (1 teaspoon per day, the therapeutic course of 2-3 weeks) was used, its formula included: organic potassium iodide (50-60 mg), vitamins A and D2 and polyunsaturated omega-3 fatty acids. To compensate for hypothyroidism, L-thyroxine (≥ 100 mkg daily) controlled by thyroid hormones, as well as to improve gonadotrophic function, was administered together with the endocrinologist. Restockage of zinc, vitamin B12, iron and folic acid was performed by administration of the combined drug (1 capsule 2 times a day, the course of 1-2 months) its formula included 5 mg of zinc sulfate, 0.75 mg of folic acid, 5 micrograms of vitamin B12, 75 mg of vitamin C and 305 mg of iron fumarate. It is known that folic acid with vitamin B12 are actively involved in the synthesis of amino acids, nucleic acids and in purine and pyrimidine metabolism, metabolism of choline. Trace elements like zinc, iodine, along with vitamin A – are necessary ingredients for the development of the gonads in adolescent girls, nerve fibers and cells of the CNS.

Evaluation of the effectiveness of the performed therapy was based on clinical and laboratory and hormonal parameters.

Statistical analysis of the results of clinical studies was performed using nonparametric statistical methods with the help of statistical programme Microsoft Excel 5.0.

3. Results

Results of our studies indicate that iodine supply of adolescent girls born with deficiency of body weight and those born with normal weight in different regions of Transcarpathia is multidirectional. Thus, the average indicator of iodineuria median in adolescent girls, who were born with a deficit of body weight and are residents of the highland region of Transcarpathia, was -77.12 mg/l, which is 1.5 times below than in the control group -112.41 mg/l, and in foothill area, this indicator was 81.85 mg/l, which is the lower limit of the norm.

We have determined a statistically significant difference in the increase of TSH levels: in the mountainous region – up to 4.15 ± 0.13 mIU/ml, in the foothills – 3.18 ± 0.10 mIU/ml, in the lowlands – 2.95 ± 0.08 mIU/ml with the decrease of T3 according to 1.32 ± 0.68 nmol/l in the mountainous region, 1.35 ± 0.32 nmol/l – in the foothills and up to 1.39 ± 0.15 nmol/l in the plain areas; ft4 level was respectively 14.1 ± 0.31 nmol/l; 14.7 ± 0.12 nmol/l and 15.9 ± 0.35 nmol/l, which indicates the existence of the relative lack of thyroid hormones in adolescent girls in conditions of natural iodine deficiency. In such situations euthyroid goitre in the period of puberty is always formed.

Comparative analysis of levels of gonadotropic and sex hormones in adolescent girls with non-established menstrual cycle shows that the indexes of FSH and LH in residents of mountainous area is somewhat smaller (4.08 ± 0.23 mIU/l; 4.03 ± 0.29 mIU/l) than in the foothill residents (4.12 ± 0.26 mIU/l; 4.56 ± 0.19 mIU/l) and flat area (4.26 ± 0.21 mIU/l; 4.95 ± 0.22 mIU/l, $p > 0.05$). The levels of prolactin and estradiol are almost the same in all groups, and only estradiol levels are significantly lower in adolescent girls who live in the

mountainous (372.58 ± 21.3 mIU/l; 30.12 ± 1.56 ng/ml) and foothill (396.14 ± 18.5 mIU/l; 35.96 ± 1.82 ng/ml) areas unlike residents of the lowland area (406.12 ± 23.1 mIU/l; 38.56 ± 14.3 ng/ml). Index of progesterone, which was defined in this group of adolescent girls during the menstrual cycle, was 4.96 ± 1.37 ng/ml in residents of mountainous area, 6.98 ± 2.13 ng/ml – in residents of foothill area and 8.96 ± 2.56 ng/ml – in residents of the plains; it was significantly lower in the mountainous and foothill areas than in the control group ($p < 0.05$).

It is clear that in adolescent girls with the definite menstrual cycles who were born with the deficient body weight and live in mountainous and foothill areas, FSH and LH indexes are slightly lower than in residents of the plains and the control group (4.12 ± 0.50 mIU/l and 4.28 ± 0.32 mIU/l vs 4.31 ± 0.23 mIU/l and 4.52 ± 0.52 mIU/l and 4.13 ± 0.2 mIU/l and 4.21 ± 0.40 mIU/l vs 5.12 ± 0.61 mIU/l and 5.15 ± 0.42 mIU/l), $p > 0.05$. Index of LH was significantly lower only in adolescent girls from mountainous area 4.13 ± 0.21 mIU/l vs 5.12 ± 0.61 mIU/l relating to the control group. The level of prolactin in girls of mountainous and foothill areas was significantly lower than in the control group, 386.33 ± 27.2 mIU/l and 398.16 ± 36.5 mIU/l vs 426.16 ± 29.3 mIU/l in the control group ($p < 0.05$). Index of estradiol was highest in groups of adolescent girls who were born with a deficit of body weight and live in the plains (39.18 ± 9.31 ng/ml) and does not significantly differ from the control group (42.14 ± 1.26 ng/ml), $p < 0.05$. At the same time, in adolescent girls of mountainous and foothill areas this index was significantly lower than in the control group and respectively was (30.24 ± 1.08 ng/ml and 36.18 ± 1.32 ng/ml, $p < 0.05$).

It was established that in adolescent girls with the determined menstrual cycles who were born with the deficient body weight and live in mountainous area, the level of progesterone during the first (6.92 ± 1.4 ng/ml) and the second (10.91 ± 2.13 ng/ml) phases of the menstrual cycle was almost 2 times lower than in the control group (12.92 ± 2.01 ng/ml and 16.12 ± 3.01 ng/ml). And the level of progesterone in the studied teenagers from the foothills and plains differed slightly (8.35 ± 1.16 ng/ml and 11.22 ± 2.11 ng/ml vs 10.62 ± 1.25 ng/ml and 14.95 ± 2.01 ng/ml, $p > 0.05$).

Analyzing the sonographic parameters of uterine and ovarian size in adolescent girls born with deficiency of body weight, living in the foothills and plains, it was determined that the length, width and thickness of uterus in adolescent girls of foothill areas in the age group of 14 – 18 years are significantly lower than the indexes of adolescent girls living in plains (3.46 ± 0.41 cm; 3.23 ± 0.29 cm; 1.96 ± 0.18 cm to 4.68 ± 0.51 cm; 3.78 ± 0.25 cm; 3.10 ± 0.21 cm, $p < 0.05$). Indicators of size of the uterus in the age group of 11 – 13 years were respectively 2.94 ± 0.12 cm; 2.24 ± 0.17 cm; 2.89 ± 0.26 cm vs 3.54 ± 0.25 cm; 2.89 ± 0.19 cm; 2.12 ± 0.11 cm ($p < 0.05$). Size of the ovaries did not significantly differ between adolescent girls from basic and control groups. Thus, the length of ovaries in residents from foothill areas was 1.92 ± 0.18 cm in girls of 11-13 years of age; 2.64 ± 0.19 cm – in girls of 14-18 years of age. The thickness respectively was – 1.65 ± 0.12 cm and 1.76 ± 0.21 cm. And the width was – 1.82 ± 0.18 cm and 2.22 ± 0.17 cm and 2.24 ± 0.23 cm respectively.

The proposed therapeutic measures influenced positively hypothalamo- pituitary-ovarian system. Free thyroxine (ft4) normalized faster than other thyroid hormones; its index was 12.71 ± 0.63 mcmol/l vs 12.72 ± 0.1 nmol/l in the group ($p < 0.05$). Levels of TSH and T3 were respectively 1.29 ± 0.34

mIU/ml and 2.82 ± 0.51 mIU/ml. The fact of normalization of gonadotropic and sex hormones especially in adolescent girls with non-established menstrual cycle was noted. Thus, the level of follicle stimulating hormone was 4.32 ± 0.26 mIU/ml, compared with the control group – 4.48 ± 0.33 mIU/ml. Average rate of luteinizing hormone was 4.62 ± 0.25 mIU/l, though in the control group it was – 5.05 ± 0.27 mIU/l; the average level of prolactin was -398.69 ± 24.3 mIU/l, 419.18 ± 23.6 mIU/l; the average level of estradiol was – 40.56 ± 1.28 ng/ml, 41.18 ± 1.57 ng/ml respectively.

Estimation of levels of progesterone during the first and the second phases of the girls with established menstrual cycle indicates that the indexes of progesterone both in the first and in the second phase of the menstrual cycle approached the level of the control group ($p > 0.05$). The level of progesterone 11.65 ± 2.13 ng/ml and 14.68 ± 2.33 ng/ml, ($p > 0.05$), against – 12.14 ± 2.11 ng/ml – 16.22 ± 3.41 ng/ml ($p < 0.05$). At the same time in the second group this index was significantly lower than in the control group ($p < 0.05$).

A positive influence of the recommended treatment is indicated by analysis of the menstrual cycle. Thus, in adolescent girls group 1 the frequency of regular menstruation – was 26 of 50 cases, representing 52% and was almost at the level of the control group – 28 (56%). Regularity of menstruation in adolescent girls group 2 was observed only in 21 patients (42%). Regular menses with some delays were noted in 18 (36%), in group 2 18 (36%) and in the control group – 16 (32%).

The frequency of dysmenorrhea also decreased up to 24.0% in group 1 vs 38.0% – in the comparison group. Thus, the frequency of psychosomatic disorders reduced, – increased irritability was observed respectively in 6.0% and 12.0% ($p < 0.05$). Engorgement and breast pain were respectively (16.0% and 30.0%, $p < 0.05$).

4. Conclusions

1. The sexual development and the formation of menstrual function in adolescent girls, who were born with low body weight in the conditions of natural iodine deficiency depends on functioning of thyrotropin-thyroid system and the degree of iodine deficiency.
2. Echographic options of the uterus and ovaries in adolescent girls born with low body weight in natural iodine deficiency are behind the standard indicators.
3. The developed complex of therapeutic-preventive measures positively affects hypothalamo-pituitary-ovarian system in adolescent girls born with low body weight in natural iodine deficiency.

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