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FEATURES OF THE COURSE OF METABOLIC SYNDROME IN CHILDREN AND ADOLESCENTS IN THE ENDEMIC ZONE OF IODINE DEFICIENCY

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✓ ***Resume***

Relevance. Today metabolic syndrome (MS) can be considered an epidemic - about 25% of the adult population suffers from this disease, with an increasing prevalence among young people. In total, there are more than 310 million people with MS in the world, MS significantly increases the risk of developing CVD (3 times) and the risk of death from them (2 times), and also increases the risk of developing NIDDM (5 times).

Purpose: To study the features of the course of metabolic syndrome in the region of iodine deficiency in adolescent children.

Materials and methods: The objects of the study were patients with metabolic syndrome: 60 patients with adolescents aged 10 to 18 years old, the control group consisted of 30 practically healthy adolescents.

Result: The vast majority of patients with TD had abdominal obesity, arterial hypertension; HDL in patients with disorders of carbohydrate metabolism and hypertriglyceridemia. In group 2 patients, in addition to abdominal obesity, which occurred in 83.3% of cases, in the first place was arterial hypertension; (86.7%). P disorders of carbohydrate metabolism (80.0%) and a decrease in HDL levels (76.7%), (63.3%).

Conclusions: In patients with metabolic syndrome in combination with thyroid dysfunction, multicomponent variants of the metabolic syndrome were more common.

Key words: obesity, insulin resistance, metabolic syndrome, arterial hypertension, body mass index.

ОСОБЕННОСТИ ТЕЧЕНИЯ МЕТАБОЛИЧЕСКОГО СИНДРОМА У ДЕТЕЙ И ПОДРОСТКОВ В ЭНДЕМИЧЕСКОЙ ЗОНЕ ЙОДДЕФИЦИТА

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✓ ***Резюме***

Актуальность. Сегодня метаболический синдром (МС) можно считать эпидемией - этим недугом страдает около 25% взрослого населения с возрастающим преобладанием среди лиц молодого возраста. Всего в мире - более 310 млн. лиц с МС, МС значительно увеличивает риск развития ССЗ (в 3 раза) и риск смерти от них (в 2 раза), а также повышает риск развития ИНСД (в 5 раз).

Цель: Изучить особенности течения метаболического синдрома в регионе йод дефицита у детей подростков.

Материалы и методы: Объектом исследования явились пациенты с метаболическим синдромом: 60 больных подростков возрасте от 10 до 18 лет контрольную группу составили 30 практически здоровых подростков.

Результат: У подавляющего большинства пациентов с ТД отмечалось абдоминальное ожирение, артериальная гипертензия; уровнь липопротеины высокой плотности ЛПВП больных нарушения углеводного обмена и гипертриглицеридемия. У пациентов 2-й группы кроме абдоминального ожирения, которое встречалось в 83,3% случаев, на первом месте была артериальная гипертензия; (86,7%). П нарушения углеводного обмена (80,0%) и снижение уровня липопротеины высокой плотности (ЛПВП) (76,7%), (63,3%).

Выводы: У пациентов, страдающих метаболическим синдромом в сочетании с тиреоидной дисфункцией, чаще встречались многокомпонентные варианты метаболического синдрома.

Ключевые слова: ожирение, инсулин резистентность, метаболический синдром, артериальная гипертензия, индекс массы тела.

YOD ETISHMOVCHILIGI MAVJUD ENDEMIK ZONADA BOLALAR VA O'SPIRINLARDA METABOLIK SINDROM NAMOYON BO'LISHI

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✓ ***Rezyume***

Dolzarbligi. Bugungi kunda metabolik sindromni (MS) epidemiya deb hisoblash mumkin - kattalar aholisining taxminan 25% ushbu kasallikdan aziyat chekmoqda, yoshlar orasida bu kasallik tarqalmoqda. Umuman olganda dunyoda 310 milliondan ortiq MS kasalligi mavjud, MS surunkali yurak etishmovchiligi (SYE) rivojlanish xavfini (3 baravar) va ulardan o'lim xavfini (2 baravar) sezilarli darajada oshiradi, shuningdek yuqori zichlikdagi lipoprotein HDL darajasi oshishi rivojlanish xavfini oshiradi (5 marta).

Xulosa: metabolik sindrom bilan qalqonsimon bezning funksional buzilishi bilan birgalikda bemorlarda metabolik sindromning ko'pkomponentli variantlari ko'proq uchraydi.

Kalit so'zlar: semirish, insulin qarshiligi, metabolik sindrom, arterial gipertenziya, tana massasi indeksi.

Relevance

Today MS can be considered an epidemic - about 25% of the adult population suffers from this disease (Zadionchenko V.S., 2005). In total, there are more than 310 million people with MS in the world, according to experts, the number of patients with MS by 2025 may exceed 500 million (Shestakova M.V. et al., 2007). A lot of studies have been carried out to study the epidemiology of MS in various populations, in which a significant difference in the prevalence of this pathology depending on gender, country, ethnic group was revealed (S.H. Wild, C.D. Byrne, 2005). This clinical condition also depends on the lifestyle, which, in turn, is determined by the socio-economic status, cultural habits and characteristics of educational opportunities in a particular country. MS is a widespread pathological condition in many populations, especially in developing countries; it has a changing phenotype with an increasing predominance among young people (Weiss R. et al., 2004; Esmaillzadeh A. et al.,The thyroid gland also suffers from insulin resistance syndrome (J. Rezzonico et al., 2010). Increased circulating insulin levels cause increased thyroid proliferation. Clinical manifestations are a larger thyroid gland and nodule formation (Semra A. et al. 2011). E.G. Gasparyan et al. (2010), when examining 95 patients with central obesity, revealed autoimmune thyroiditis in 38% of patients, overt or latent hypothyroidism in 24% of patients, an increase in the volume of the thyroid gland in 67% of patients (Gasparian E. et al., 2012).

Purpose: To study the features of the course of metabolic syndrome in the region of iodine deficiency in adolescent children.

Research objectives:

1. To determine and study the clinical and anamnestic characteristics of children and adolescents with metabolic syndrome and obesity.
2. To carry out a comparative characteristic of the state of the hormonal status of the thyroid gland, pituitary gland in children and adolescents with obesity and metabolic syndrome.

Material and methods

The objects of the study were patients with metabolic syndrome: 60 patients with adolescents aged 10 to 18 years, the control group consisted of 30 practically healthy. Patient selection criteria were based on the 2005 "global MS consensus" with a waist circumference (WC) of 72 cm for boys and 64 cm for girls, plus any two of the following Serum triglycerides from 1.7 mM / L or Cholesterol high lipoprotein levels density (HDL) less than 1.03 mM / l for boys and less than 1.29 mM / l for girls Reference values total cholesterol 3.6-5.2 mmol, low-density lipoprotein (LDL) level 2.59-4 mmol; HDL 1.02-2.1 mmol; very low density lipoprotein (VLDL) level 0.13-0.9 mmol; coefficient 0-4.0.

Systolic blood pressure (BP) from 120 mm Hg or diastolic blood pressure from 80 mm Hg. Fasting blood serum glucose from 6.1 mM / L. Thyroid function was assessed by the level of thyroid stimulating hormone (TSH) concentration (0.27 - 4.2 mIU / L), T4 (58 - 161 nmol / L), T3 (1,

1 - 2.9 nmol / l), free T4 (12.0 - 22.0 nmol / l), antibodies to thyroid peroxidase (0.00 - 34.00 IU / ml). Determination of the level of thyroid hormones was carried out by the method of enzyme-linked immunosorbent assay on a Cobas 6000 modular analyzer with an enzyme immunoassay module (Modular E170, Cobas 601) (Roche Diagnostics), with a TSH value above 4 mIU / L. and the indices of free T4 were normal, the diagnosis of subclinical hypothyroidism was established. When the TSH values were above 4 mIU/L, and the free T4 values were lowered, the diagnosis of overt hypothyroidism was established. The diagnosis of nodular goiter was established in the presence of a palpable formation with a diameter of more than 5 mm in the thyroid gland, confirmed by ultrasound. The diagnosis of autoimmune thyroiditis was established when a patient was found to have an increased titer of antibodies to thyroid peroxidase, and a diffuse decrease in the echogenicity of her tissue during ultrasound examination, and a dense consistency of thyroid tissue on palpation. All examined were divided into 2 groups: group I consisted of 30 obese children and adolescents. Group II consisted of 30 children and adolescents with metabolic syndrome. The average age of the examined in the 1st group was 12.2 ± 0.7 years, in the 2nd group 12.3 ± 0.6 years. The body weight was assessed in comparison with the expected one and was consistent with the generally accepted gradation proposed by Yu.A. Knyazev. (Sep I - 10-24%, II - 25-49%, III - 50-99%, G / -> 100%). In addition, the percentile value of the body mass index (Quetelet-2, kg / m) was determined for the corresponding age and gender of the child, where the values in the 85-94 percentile corridor were regarded as the body mass index (BMI), but equal to or exceeding 95 percentile like obesity. Arterial hypertension as part of the metabolic syndrome (MS) was determined according to the IDF 2005 criteria: systolic blood pressure from 120 mm Hg. or diastolic blood pressure from 80 mm Hg. The main biochemical indicators determined in this group of patients were: indicators of total cholesterol (TC), HDL cholesterol, LDL cholesterol and very low density (VLDL cholesterol), TG, atherogenic index (IA), free thyroxine (free T4) thyroid stimulating hormone (TSH), antibodies to thyroperoxidase (AT to TPO). The study was carried out on a Cobas 6000 modular analyzer (Roche Diagnostics, Switzerland) with a biochemical module (Modular P800, Cobas 501). Biochemical parameters were determined in venous blood plasma taken after 12-hour fasting.

Carbohydrate metabolism was assessed by the level of glucose in the blood in the morning on an empty stomach, a glucose tolerance test (GTPT) was performed according to the method proposed by Academician V.G. Baranov. The glucose content during OGTT was determined in capillary blood by the glucose oxidase method. The test was carried out against the background of a normal diet without restriction of carbohydrate intake. To assess the degree of compensation of diabetes mellitus, glycated hemoglobin (HbAlc) was determined (the norm was up to 5.9%). Blood analysis for glycated hemoglobin was performed on a D10 analyzer (BioChemMac) by high pressure liquid ion exchange chromatography. The lipid spectrum of blood serum was determined on a Cobas 6000 modular analyzer (Roche Diagnostics, Switzerland) with a biochemical module (Modular P800, Cobas 501) in venous blood plasma taken after 12-hour fasting. LDL cholesterol levels were calculated using the formula: LDL cholesterol = cholesterol- (HDL cholesterol + VLDL cholesterol); where CH VLDLP = TG / 5 (Friedewald W.T., 1972). The atherogenic coefficient (CA) was determined by the formula (Klimov A.N., 1977): CA = (HDL-cholesterol) / HDL cholesterol. The calculation of the index of insulin resistance HOMA-R was carried out according to the formula: HOMA-R = GoxINS (p-22.5, where: Go - fasting blood plasma glucose concentration (mol / L), INS0 - insulin concentration in serum fasting (μU / ml), 22.5 - coefficient. Insulin resistance is evidenced by the index values exceeding: 2.5 units. - prepubertal age and 4 units. - puberty and older (Malyavskaya SI., 2008).

Correlation analysis was performed using Pearson's method (r). The reliability of the correlation was considered when the value r> 0.5 and <-0.5.

Result and discussion

As can be seen from Table 1, the overwhelming majority of patients with TD had abdominal obesity, arterial hypertension; HDL patients. disorders of carbohydrate metabolism and hypertriglyceridemia In patients of the 2nd group, in addition to abdominal obesity, which occurred in 83.3% of cases, in the first place was arterial hypertension; (86.7%). P disorders of carbohydrate metabolism (80.0%) and a decrease in HDL levels (76.7%). (63.3%).

Table no.1
The incidence of MS components in patients from groups 1 and 2.

Sign	N 1 (%)	N 2 (%)
Abdominal obesity	25 (83,3)	25 (83,3)
Arterial hypertension	5 (16,7)	26 (86,7)
Decreased HDL levels	4 (13,3)	23 (76,7)
Carbohydrate Omen Disorders	3 (10,0)	24 (80,0)
Hypertriglyceridemia	4 (13,3)	19 (63,3)

When pairwise comparison of the groups, the weight indicators significantly differed in the 1st and 2nd groups ($p < 0.05$). In the 1st group, a negative regression relationship ($P < 0.05$) was found between the indicators of wT4 and weight. This means that with a decrease in the level of wT4, the weight of patients with TD increased, i.e. decreased thyroid function led to weight gain.

Table No. 2
Comparative characteristics of anthropometric indicators in groups.

Indicators	1-st group	2-st group	P
Weight, kg	44,2±1,5	52,9±1,3	<0,01
BMI, kg / m2	24,3±0,7	28,5±0,8	<0,05
FROM, cm	62,5+2,1	74,9±1,9	<0,05

Note: P - reliability of differences between I and II and groups of patients.

In group 2, a positive regression relationship ($b = 0.28$, $p < 0.05$) was found between TSH and weight. This means that with increasing weight of patients with MS, the level of TSH increased. In this group, a positive regression relationship ($b = 0.35$, $p < 0.05$) was also found between the indicators of TK and weight. This means that with increasing weight of patients with MS, the TK level increased. In addition, we found a positive regression relationship ($b = 0.34$, $p < 0.05$) between the parameters of the thyroid gland volume and weight, which indicates that with increasing weight in patients with MS, the volume of the thyroid gland increased.

Table 4. Comparative characteristics of blood pressure indicators in groups.

Indicators	1-st group	2-st group	P
SBP, mm Hg	95,1±2,8	118,3±3,11	<0,01
DBP, mm Hg	64,8 ±1,7	79,5±1,3	<0,05

Note: P - reliability of differences between I and II and groups B

On average, the value of systolic blood pressure in the group of patients with metabolic syndrome was significantly higher in comparison with the indicators of patients in group 1 by 23 mm Hg. There was also a statistically significant difference ($P < 0.05$) between the DBP values of the 1st and 2nd groups of significant differences, so on average, the value of diastolic blood pressure in the group of patients with metabolic syndrome was significantly higher compared to the indicators of

patients in group 1 by 14.7 mm Hg In the 1st group, a positive inverse relationship was found between the indicators of DBP and TK. This means that with a decrease in the TK level in patients with TD, the DBP level increased.

Indicators of lipid and carbohydrate metabolism in groups.

Indicators	1-st group	2-st group	P
Total cholesterol, mmol / l	4,28±0,23	5,61+0,14	<0,01
LDL, mmol / l	3,28±0,48	3,98±0,16	<0,01
HDL, mmol / l	1,5+0,09	1,38±0,04	<0,05
TG, mmol / l	0,95±0,11	1,25±0,08	<0,05
Atherogenic index	2,54±0,23	3,27±0,08	<0,01
HbAlC,%	5,21+0,21	6,27±0,59	<0,05
Glucose, mmol / l	4,51+0,12	5,98+0,24	<0,01

Note: P - reliability of differences between I and II and groups

The average values of TSH in the group of patients with MS were higher in comparison with the indicators of the 1st group by an average of 15 mIU / L. Indicators of TK. In the 2nd group were significantly lower than in the 1st group of patients ($p < 0.05$). When comparing TK indicators in groups 1 and 2, no significant differences were found. In the 2nd group of patients, a positive quadratic relationship was found between the total cholesterol and TSH ($B = 0.41$, $p < 0.05$). In the 2nd group of patients, a positive quadratic relationship was found between the total cholesterol and TSH ($B = 0.41$, $p < 0.05$. A negative correlation was found between the indicators of GCS and TZ ($r = -0.65$, $p < 0.05$), a negative correlation between the indicators of GCS and svT4 ($r = 0.61$, $p < 0.05$). negative correlation between the indicators of GCS and TK ($r = -0.65$, $p < 0.05$). a positive correlation was found between the indicators of total cholesterol and antibodies to TPO ($r = 0.43$, $p < 0.05$). This means that with an increase in the level of AT to TPO in patients with MS in combination with TD, the level of total cholesterol increased. A positive inverse regression relationship was found between the total cholesterol level and the volume of the thyroid gland ($b = 0.61$, $p < 0.05$). This means that with a decrease in the volume of the thyroid gland, the level of total cholesterol increased.

Indicators of the functional state of the thyroid gland in groups

Indicators	1-st group	2-st group	P
TSH, mIU / l	1,75±0,11	16,39±5,48	<0,001
T3, nmol / l	2,16±0,23	1,97±0,11	<0,05
T4sv, nmol / l	17,13+0,24	10,94±0,87	<0,001
T4, nmol / l	87,95+3,46	97,73±2,60	<0,05
AT to TPO, IU / ml	858,35±449,33	19,92+7,31	<0,001
Thyroid volume ml	14,39+2,69	13,73+0,96	>0,5

Note: P - reliability of differences between I and II and groups

In the 1st group of patients, a positive inverse regression relationship was found between the indicators of LDL and AT to TPO (B = 0.98, p <0.05). between the indicators of LDL and the volume of the thyroid gland (b = 0.81, p <0.05, between the indicators of HDL and T3 (B = 0.54, p <0.05) A pronounced negative correlation was found between the indicators of TG and wT4 (r = -0.97, p <0.05). A pronounced negative correlation between the indicators of TG and svT4 (r = -0.97, p <0.05). In the 1st group of patients, a positive inverse regression relationship was found between the indicators LDL and anti-TPO antibodies (B = 0.98, p <0.05) A positive inverse regression relationship was found between LDL and thyroid volume (b = 0.81, p <0.05).

Indicators of blood pressure, lipoprotein metabolism and the functional state of the thyroid gland in the groups

Indicators	1-st group (n=30)	2-st group (n=30)	P
SBP, mm Hg	95,1±2,8	118,3±3,11	<0,01
DBP, mm Hg	64,8 ±1,7	79,5±1,3	<0,05
Total cholesterol, mmol / l	4,28±0,23	5,61+0,14	<0,01
LDL, mmol / l	3,28±0,48	3,98±0,16	<0,01
HDL, mmol / l	1,5+0,09	1,38±0,04	<0,05
TG, mmol / l	0,95±0,11	1,25±0,08	<0,05
Atherogenic index	2,54±0,23	3,27±0,08	<0,01
HbAlC,%	5,21+0,21	6,27±0,59	<0,05
Glucose, mmol / l	4,51+0,12	5,98+0,24	<0,01
TSH, mIU / l	16,39±5,48	1,75±0,11	<0,001
T3, nmol / l	2,16±0,23	1,97±0,11	<0,05
T4sv, nmol / l	10,94±0,87	17,13+0,24	<0,001
T4, nmol / l	87,95+3,46	97,73±2,60	<0,05
AT to TPO, IU / ml	858,35±449,33	19,92+7,31	<0,001
The volume of the thyroid gland	14,39+2,69	13,73+0,96	>0,5

Note: P - reliability of differences between I and II and groups of patients.

The weight of the patients naturally increased as the severity of thyroid dysfunction increased. The significance of the differences between the 1st and 2nd subgroups p <0.05.

Correlation matrix of the studied indicators (r)

Indicators	TSH		T4 free	
	1-st group	2-st group	1-st group	2-st group
Weight	0,87	0,71	0,87	0,90

BMI	0,87	0,76	0,90	0,89
SBP	0,90	0,89	0,87	0,88
Glucose	0,84	0,95	0,85	0,91
OHC	0,73	0,84	0,70	0,96

The data obtained indicate a very high direct correlation between the correlation of weight and thyroid-stimulating hormone (r = 0.87), BMI and thyroid-stimulating hormone (r = 0.86), which indicates the validity of using these clinical criteria in determining thyroid status in patients with obesity.

High direct correlation (r = 0.82) between the indicators of SBP and thyroid-stimulating hormone high correlation coefficients (r = 0.85; r = 0.93), indicating a high and very high direct correlation between the indicators of glucose, total cholesterol and thyroid-stimulating hormone high direct correlation the relationship between the indicators of normalization of BMI and free T4 (r = 0.87), which proves the validity of using these anthropometric criteria in the prognosis of thyroid diseases in obese patients. The relationship between the indicators of glucose, total cholesterol, BMI, SBP and TSH, free T4, which determines the decisive role of in-depth diagnostics of metabolic syndrome in determining the prognosis of thyroid dysfunction, in determining the risk of developing thyroid insufficiency in patients with both obesity and metabolic syndrome.

Conclusions

1. In patients suffering from metabolic syndrome in combination with thyroid dysfunction, multicomponent variants of the metabolic syndrome were more common. With an increase in the number of components of the metabolic syndrome, there was an increase in the severity of its clinical manifestations and a decrease in the functional activity of the thyroid gland.

2. In patients with metabolic syndrome in combination with thyroid dysfunction, there was a higher incidence of obesity and hypertriglyceridemia. These patients had higher weight, triglycerides, and LDL cholesterol than those with metabolic syndrome without thyroid dysfunction.

3. Patients with MS in combination with overt thyroid dysfunction had higher weight, total cholesterol, LDL, TG and lower HDL values than those with metabolic syndrome combined with subclinical thyroid dysfunction.

4. A high and very high strength of the correlation relationship between the indicators of glucose, total cholesterol, BMI, SBP and TSH, free T4 was revealed, which determines the decisive role of an in-depth diagnosis of metabolic syndrome in determining the prognosis of thyroid dysfunction, in determining the risk of developing thyroid insufficiency in patients both obesity and metabolic syndrome.

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