STUDYING THE SEVERITY OF METABOLIC SYNDROME IN YOUNG PEOPLE WITH ARTERIAL HYPERTENSION

[1]Minovarova Charrazkhon Anvarovna, [2]Atakhodjaeva Gulchekhra Abdunabievna
[1]PhD doctoral student, "Department of Internal Medicine,nephrology and hemodialysis" Tashkent Pediatric Medical Institute
[2]DSc., Associate Professor,Department of Internal Medicine, nephrology and hemodialysis Tashkent Pediatric Medical Institute
https://doi.org/10.5281/zenodo.10119207

Abstract. *Purpose of the study: to study the influence of hormonal factors in young people with arterial hypertension against a background of obesity. 81 patients (43 men and 38 women) of young age (from 18 to 44 years) with arterial hypertension and abdominal obesity were examined. Depending on the presence of arterial hypertension and excess body weight. In young people with normal weight, as well as in obese people, cardiometabolic changes can be detected, which allows for the timely diagnosis of these disorders and the implementation of effective strategies for the primary prevention of cardiovascular and metabolic diseases.*
Keywords: *arterial hypertension, young age, abdominal obesity, cardiometabolic risk.*

In recent years, the incidence of arterial hypertension (AH) in young people has been increasing along with the increasing prevalence of abdominal obesity (AO) [4, 7, 12]. It is generally accepted that obesity plays an important role in the pathogenesis of hypertension in adolescence and young adulthood. At the same time, the likelihood of hypertension in overweight individuals also depends on ethnicity, family history, lifestyle, physical activity and sleep quality. High tolerance to cardiorespiratory stress and a number of genetic polymorphisms may play a protective role against the development of hypertension. In young people with hypertension and overweight, there are a number of differences in the level of hormones and the activity of enzymes of the renin- angiotensin system, indicators of lipid metabolism and inflammatory activity [1, 7, 10, 15, 17].

There are no universal recommendations for determining the low risk of hypertension in overweight at a young age. However, European, North American and International guidelines emphasize the importance of assessing the complications and comorbidities associated with excess weight. Most recommendations suggest screening blood pressure (BP) in overweight and obese adolescents starting from adolescence [1, 2, 7, 10, 15, 16, 17].

According to WHO experts, the spread of overweight and obesity among young people and adolescents has reached epidemic proportions in recent years [1, 10, 13, 14, 17]. Epidemiological studies indicate that up to 32% of young people in economically developed countries are obese or overweight [4, 7, 8, 10, 14]. At the same time, the prevalence of obesity in the global population continues to increase. The criticality of the situation is due to the fact that along with the prevalence of obesity, the frequency of concomitant diseases, in particular cardiovascular diseases, which are currently the leading cause of mortality worldwide, is increasing [2, 4, 7, 10, 17].

Based on the above data, the purpose of the study was to study the influence of hormonal factors in young people with hypertension against a background of obesity.

Material and research methods.

To achieve this goal, we examined 81 patients (43 men and 38 women) of young age (from 18 to 44 years) with arterial hypertension (AH) and the presence of abdominal obesity (AO). All patients were undergoing inpatient treatment in the cardiology department of the State Institution "Republican Specialized Scientific and Practical Medical Center for Therapy and Medical Rehabilitation" of the Ministry of Health of the Republic of Uzbekistan. Depending on the presence of hypertension and excess body weight, all examined patients were divided into 3 study groups:

Group 1 (control) – young people without hypertension and without AO: with a metabolically healthy phenotype and normal body weight (body mass index 18.5–24.9 kg/m2) – 26 people (age 27.45±5.83 years; 13 men and 13 women).

Group 2 – young patients with hypertension with normal body weight – 29 people (age 28.9±7.51 years, 15 men and 13 women). The duration of hypertension in the 2nd group of the study was 5.82±3.25.

Group 3 – young patients with hypertension and AO (body mass index ≥25 kg/m2) – 27 people (age 30.04±6.78 years; 15 men and 12 women). The duration of hypertension in this group was 6.7±3.44 years and the duration of obesity was 8.57±3.44.

Inclusion criteria: young age 18–44 years; AH I-III degrees. Waist circumference (WC) (>94 cm for men and >88 cm for women) was considered as the main components of abdominal obesity (AO); overweight (BMI ≥25 kg/m2) and obesity (BMI ≥30 kg/m2).

Exclusion criteria: secondary – symptomatic hypertension; clinical associated conditions: chronic kidney disease C4–C5 stage (glomerular filtration rate less than 30 ml/min/m2) and/or diabetes mellitus, organic and functional damage to target organs; diffuse connective tissue diseases; acute or chronic diseases in the stage of exacerbation or decompensation; abuse of alcohol and other psychoactive substances; pregnancy, lactation period.

All patients were examined with an assessment of waist circumference, calculation of body mass index, and measurement of blood pressure in accordance with the clinical protocol [1, 2, 7, 10]. All patients, in the presence of a doctor, filled out a specially designed questionnaire, which included blocks of questions about hereditary history, smoking, the presence of concomitant diseases, and behavioral factors [12, 14, 16]. At the time of the examination, none of the patients included in the study were taking antihypertensive drugs, as well as drugs affecting carbohydrate and lipid metabolism, on a regular basis.

The criteria for metabolic syndrome were the deviation of three or more of the listed criteria for metabolic syndrome: total cholesterol ≤5 mmol/l; triglycerides ≤1.7 mmol/l; high-density lipoprotein cholesterol (HDL-C) ≥1.0 mmol/L in men and ≥1.2 mmol/L in women; low-density lipoprotein cholesterol (LDL-C) ≤3 mmol/l; index of insulin resistance HOMA-IR (Homeostasis Model Assessment of Insulin Resistance) ≤2.8 [6, 7].

The following MS parameters were analyzed from laboratory parameters: glucose , mmol/l; Immunoreactive insulin, μU /ml; Total cholesterol (TC), High-density lipoprotein cholesterol (HDL-C), Low-density lipoprotein cholesterol (LDL-C), Triglycerides; Leptin, ng /ml; Adiponectin , μg/ml (on a Biochem enzyme immunoassay analyzer Analette (HTI, USA)).

Statistical processing was carried out using Microsoft Excel, including the use of built-in statistical processing functions. Methods of variational parametric and non-parametric statistics were used with the calculation of the arithmetic mean of the studied indicator (M), standard deviation (SD), relative values (frequency, %), the statistical significance of the obtained

measurements when comparing average values was determined by Student's test (t) with calculation of the probability of error (R). Comparisons of three or more independent groups were performed using one-way ANOVA analysis of variance. A significance level of $P < 0.05$ was accepted as statistically significant changes.

Research results

The results of the analysis of the studied parameters in young people revealed that all examined patients were comparable in terms of duration of hypertension and gender differences. Patients in the group of metabolically unhealthy obesity (group 3) were significantly older compared to representatives of the first two groups ($P < 0.01$).

However, hemodynamic parameters varied depending on the presence of hypertension and the degree of obesity. Thus, in the 2nd group, the values of SBP and DBP were increased by 32.8% and 26.2%, in contrast to the data of the 1st group of the study ($P < 0.001$). In group 3, these same indicators were higher by 38.8% and 33.5%, respectively, in contrast to the data in group 1 of the study ($P < 0.001$). The differences between the 2nd and 3rd groups were not significant ($P>0.05$).

Table 1

Clinical characteristics of patients

Indicator	Group 1 (n=26)	Group 2 (n=28)	Group 3 (n=27)
Age, years	27.45±5.83	28.9±7.51	35.04±6.78**
Men, abs (%)	13 (50%)	15 (53.6%)	15 (55.5%)
Women, abs (%)	13 50(%)	13 (46.4%)	12 (45.5%)
Duration of hypertension, years	-	5.82±3.25	6.7±3.44
Duration of obesity, years	--	-	8.57±3.44
1st degree hypertension	-	11 (39.3%)	7 (26.0%)
Stage 2 hypertension	-	12 (42.9%)	11 (40.7%)
Stage 3 hypertension	-	5 (17.6%)	9 (33.3%)
Obesity 1 (BMI> kg/m2)	-	-	10 (37.0%)
Obesity 2 (BMI > kg/m2)	-	-	12 (44.4%)
Obesity 3 (BMI > kg/m2)	-	-	5 (18.5%)
BMI, kg/m2	20.67±3.44	23.6±3.02	32.5±3.35*** ###
SBP, mmHg Art.	116.82±13.14	154.3±16.94***	161.1±19.17***
DBP, mmHg Art.	76.31±7.65	96.3±12.46***	101.1±11.81***
Heart rate, beats per minute	75.66±12.33	79.24±10.8	88.92±11.6**#

Note: * p< 0.05; ** p<0.01; ***p <0.001 in relation to the data of the 1st study group, # p<0.05% ###p<0.001 differences between the 2nd and 3rd study groups.

Differences in BMI values were determined by the distribution of obesity among groups. In particular, the differences in the BMI parameter between the 1st and 2nd groups were not significant (P>0.05). At the same time, these differences between the 1st and 3rd groups were 57.2%, and between the 2nd and 3rd groups - 37.7% (P < 0.001).

table 2

Patient metabolic profile parameters

Indicator	Group 1 (n=26)	Group 2 (n=28)	Group 3 (n=27)
Total cholesterol, mmol/l	4.54±0.56	5.21±0.32*	6.76±1.31***
LDL cholesterol, mmol/l	2.13±0.65	2.87±1.09	3.89±1.16***
HDL cholesterol, mmol/l	2.15±0.45	1.98±0.73	1.42±0.51**
TG, mmol/l	0.82±0.33	1.05±0.55	1.97±0.89***
Blood glucose, mmol/l	4.47±0.47	5.39±0.44***	5.66±0.63***
Immunoreactive insulin, μU /ml	9.66±3.2	22.73±11.56***	25.92±10.5***
IR index (HOMA-IR)	1.7±0.7	5.9±2.12***	4.41±2.2***
Leptin, ng /ml	10.0±5.1	27.7±7.87***	42.8±12.45***##
Adiponectin , μg/ml	9.1±3.22	8.98±5.2**	6.95±4.91***

Note: * p< 0.05; ** p<0.01; ***p <0.001 in relation to the data of the 1st study group, # p<0.05% ###p<0.001 differences between the 2nd and 3rd study groups.

In the 2nd and 3rd groups with a metabolically unhealthy profile, the highest concentrations of glucose, insulin and the HOMA-IR insulin resistance index were detected compared to the 1st comparison group. Thus, the differences in these parameters between the 1st and 2nd groups were 20.6%, 2.35 times and 3.5 times, respectively (P < 0.001). The differences between the 1st and 3rd groups above the above parameters were 26.6%, 2.7 and 2.6 times, respectively (P < 0.001). The highest concentrations of triglycerides and LDL-C, as well as the lowest values of HDL-C, were found in the group with metabolically unhealthy obesity, i.e. in the 3rd study group compared with the 1st and 2nd study groups, without obesity (P < 0.001). Our research results also coincide with similar data from foreign and domestic studies [9, 13, 14].

Along with the identified disorders of carbohydrate and lipid metabolism, in the 2nd and 3rd groups of the study with hypertension, regardless of the presence of obesity, there was a high concentration of leptin by 2.8 times and 4.22 times (P < 0.001), in contrast to the data of the 1st group. At the same time, in the 3rd group of patients with hypertension and obesity, a lower concentration of adiponectin was observed compared to the 1st and 2nd groups of the study by 29.2% (P<0.01), between the 1st and 3rd groups by 30.9% (P< 0.001)

Studying the correlation relationships between biochemical and clinical parameters of the metabolic syndrome in young individuals with a metabolically unhealthy phenotype in the 3rd group of the study, positive linear correlations of moderate strength were obtained between BMI and adenopectin (r = -0.382, P < 0.05) and between the concentration of leptin (r=0.377, P<0.05). Among individuals with a metabolically unhealthy phenotype (group 3), statistically significant positive linear correlations of moderate strength were identified between leptin concentrations and the level of SBP (r=0.478, P<0.05), and DBP (r=0.493, P<0. 05), as well as between SBP and the insulin resistance index (HOMA-IR) (r=0.414, P<0.05), between DBP and the IR index (HOMA-IR) (r=0.458, P<0.05).

In the group of young people with hypertension without obesity (group 2), a negative correlation of moderate strength was revealed between BMI and adenopectin levels (r = –0.525, P < 0.01).

Thus, the results obtained complement the current understanding of metabolic disorders in young people. A metabolically unhealthy phenotype is characteristic not only of obese individuals, but also of individuals with normal body weight. In young people with normal weight, as well as in obese people, cardiometabolic changes can be detected, which allows for the timely diagnosis of these disorders and the implementation of effective strategies for the primary prevention of cardiovascular and metabolic diseases.

Conclusions

1. The most pronounced cardiometabolic disorders, including changes in carbohydrate and lipid metabolism, were identified in the group of young patients with metabolically unhealthy obesity (P < 0.001).

2. In young people with metabolically unhealthy obesity, a higher frequency of the combination of obesity with arterial hypertension and lower concentrations of adiponectin in the blood serum were determined compared with patients with normal body weight.

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