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STATUS OF RENAL HEMODYNAMICS IN CHILDREN AND ADOLESCENTS WITH OBESITY

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Abstract: The study involved 35 children aged 7 to 18 years (mean age of children 12.14±0.18 years), with exogenous constitutional obesity. The control group included 20 practically healthy children with normal body weight. In this study, a clear relationship was obtained between the degree of obesity and the severity of carbohydrate metabolism disorders and dyslipidemia in children and adolescents, which was expressed in an increase in the level of cholesterol, triglycerides, LDL and in a decrease in HDL, an increase in immunoreactive insulin and an increase in the IR HOMA R. in children with high microalbuminuria. It was revealed that in children with obesity and microalbuminuria, violations of renal hemodynamics at the level of interlobar and arcuate renal arteries are determined. A statistically significant decrease in Vmin at the level of large renal vessels allows us to consider these changes as a marker of early renal hemodynamic disorders.

Keywords: *obesity, children, microalbuminuria, renal hemodynamics*

Relevance: In modern society, overweight and obesity are among the most pressing problems. The number of overweight patients is steadily increasing and, according to some reports, is doubling every three decades. Obesity is pathogenetically associated with several cardiovascular risk factors, such as diabetes mellitus and arterial hypertension, which often lead to kidney damage; obesity itself is associated with unfavorable renal hemodynamics, which, regardless of these factors, can contribute to kidney pathology. Markers of renal damage, along with damage to the partial functions of the kidneys, are changes in the kidneys according to the Doppler method of research. Ultrasonic Doppler, a method that allows you to qualitatively and quantitatively assess the blood flow through the vessels of the kidneys, the functional state of the renal parenchyma and the nature of pathological changes in it.In this regard, the study of renal hemodynamics based on Dopplerography of the kidneys in children with obesity is of scientific and practical interest and led to the setting of the goal of our study.

Purpose of the study: To study the nature of violations of renal hemodynamics using the method of ultrasonic doplerometry.

Material and methods: our studies were carried out in family polyclinics of the city of Samarkand (Uzbekistan). The study involved 35 children aged 7 to 18 years (mean age of children

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12.14±0.18 years), with exogenous constitutional obesity. The control group included 20 practically healthy children with normal body weight.

Anthropometric studies were carried out using standard measuring instruments (floor stadiometer and medical scales). Anthropometric measurements include: height, body weight, waist and hip circumference. Comparison of the obtained data and assessment of physical development was carried out according to the WHO centile tables of age and gender distribution of height and body weight for children aged 5-19 years [1]. Body mass index (BMI) was calculated based on the measurements.

The results were evaluated using standard deviations of BMI (SDS) in accordance with WHO recommendations [1]. Obesity in children and adolescents should be defined as +2.0 SDS BMI, overweight +1.0 to +2.0 SDS BMI, and underweight -1.0 to -2.0 SDS BMI [1] . All children included in the study were residents of the Samarkand region.

Microalbuminuria was determined in morning urine by a semi-quantitative method using visual test strips for microalbuminuria MICRAL-TEST II (Mikral-Test 2) Roche Diagnostics.

The concentration of glucose in the blood serum was determined by the glucose oxidase method. Cholesterol (CH), high-density blood cholesterol (HDL) was determined using the enzymatic method. Low-density lipoprotein cholesterol (LDL) and very low density lipoprotein cholesterol (VLDL) were determined by Friedwald's formulas. The level of immunoreactive insulin (IRI) was determined by enzyme immunoassay (ELISA) with the calculation of HOMAR IR indices according to the formulas.

All patients underwent ultrasound examination of the renal arteries using the Voluson P8 apparatus. We used convex and spectral sensors with a scanning frequency of 3.5 MHz. With color Doppler mapping, a qualitative assessment of hemodynamics in the kidney parenchyma was carried out.

Quantitative analysis of the spectrum of the Doppler frequency shift was performed using computer programs built into the ultrasound machine. To quantify the results, such indicators as the resistivity index RI, the maximum blood flow velocity Vmax, and the minimum (end-diastolic) blood flow velocity Vmin were determined.

Statistical processing of the obtained data was carried out on a personal computer using the Statistica 10 program. Methods of variational parametric and nonparametric statistics were used with the determination of the arithmetic mean (M), standard deviation (σ), standard error of the mean (m), relative values (frequency, %). The statistical significance of the measurements obtained was determined by Student's t-test (t) with the calculation of the error probability (P).

Research results: An analysis of the quantitative values of metabolic parameters characterizing comorbidity in obesity in children and adolescents, in conjunction with the severity of obesity, revealed a statistically significant increase in the median of all parameters characterizing lipid and carbohydrate metabolism with an increase in body weight. The data were obtained in a comparative analysis after determining the presence and level of albumin in the urine of children in the study groups. After its determination by the level of MAU, we divided the children of the main group into two subgroups: group 1 with MAU up to 20 mg/l, group 2 with MAU >20 mg/l.

Doppler examination of the kidneys revealed that in both comparison groups there were no significant differences in the RI resistivity index compared to children in the control group.

Studying the literature data, it was found that the change in RI in patients with severe obesity with the presence of microalbuinuria is accompanied by a significant decrease in RI at the level of the interlobar and arcuate arteries. At the same time, RI indicators in the group of patients with overweight or obesity of 1-2 degrees were without significant deviations from normal values [5].

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According to other authors, there were no significant differences between the mean RI value in children with normal urinary albumin levels and microalbuminuria [4]. In our study, despite the difference between the two groups, the indicators were not significant.

The difference according to Dopplerography in the two compared groups was a significantly significant increase in the level of maximum blood flow velocity Vmax in the trunk of the renal artery, as well as in the segmental, interlobar and arcuate arteries, as well as a statistically significant increase in the minimum blood flow velocity Vmin in the interlobar and arcuate arteries in the group of children with obesity and microalbuminuria and compared with the control group.

In sick children with obesity and MAU at the level of the interlobar and arcuate arteries, a decrease in the average indicators of peripheral resistance below normal values was noted, i.e. as the degree of manifestations of microalbuminuria increased, blood flow indicators tended to decrease at all levels of the renal artery.

The data obtained are evidence of the onset of impaired renal function, when intrarenal hemodynamic disorders are the basis, namely the development of intraglomerular hypertension, hyperfiltration developing in this condition is a consequence of this. The kidney has the ability to increase perfusion pressure to give a corresponding increase in vascular resistance. In response to an increase in blood pressure, the tone in the renal vessels should increase accordingly, i.e. voltage increases, the vessel narrows and the resistance to blood flow increases, which should have been reflected in RI.

However, the vascular resistance index at both stages, that of microalbuminuria and microalbuminuria, did not change significantly, which characterizes the compensatory mechanism for increasing the rate of intrarenal blood flow, as well as the factor that keeps the increase in intraglomerular hypertension.

In children with obesity and MAU, there was a decrease in the end-diastolic blood flow velocity both in large arteries (stem, segmental) and in small arteries (interlobar and arcuate) of the kidneys, which was a reflection of the earliest stages of intrarenal hemodynamic restructuring in this category of patients.

Thus, a decrease in the end-diastolic blood flow velocity in the kidney vessels of all calibers can be considered an early marker for the development of kidney damage in children with obesity and MAU.

Conclusions: Proteinuria and UIA are important factors in kidney damage and, according to recent studies, are increasingly common in overweight and obese people, even in the absence of diabetes mellitus. In this study, a clear relationship was obtained between the degree of obesity and the severity of carbohydrate metabolism disorders and dyslipidemia in children and adolescents, which was expressed in an increase in the level of cholesterol, triglycerides, LDL and in a decrease in HDL, an increase in immunoreactive insulin and an increase in the IR HOMA R.

It was also found that already at the stage of microalbuminuria in children with obesity, violations of renal hemodynamics at the level of the interlobar and arcuate renal arteries are determined, with the progression of kidney damage, kidney vessels of a larger caliber (segmental and stem) are involved in the process. A statistically significant decrease in Vmin at the level of large renal vessels, as well as in the arcuate artery, allows us to consider these changes as a marker of early renal hemodynamic disorders and require further study.

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