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Negative Influence Of Obesity On Non-Glomerular Chronic Kidney Disease In Children.

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ABSTRACT

In the article kidney function parameters (blood creatinine level, glomerular filtration rate), and level of kidney injury molecules (KIM-1) in urine in cases of chronic kidney diseases of children with or without obesity were analyzed. It has been found out, that obese children with chronic kidney diseases have higher level of blood creatinine and lower glomerular filtration rate compared to non-obese children with chronic kidney diseases. In addition, obese children with chronic kidney diseases are at higher risk of exacerbation of pyelonephritis and have higher level of KIM-1 in urine.

Keywords: children, chronic kidney disease, obesity, kidney injury molecules

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INTRODUCTION

In recent years, many papers cover detecting new markers of kidney injury. Among these markers, the kidney injury molecule-1 (KIM-1) plays an important role [1, 2, 3, and 4]. Diagnostic significance of this marker for the assessment of the severity of kidney injury in children with obesity was demonstrated [5]. In case of children's chronic kidney disease, assessment of the level of this marker depending on the body weight would be important for the assessment of the degree of kidney injury. Besides, many authors pay attention to the kidney disease features in children with obesity in comparison with a similar course of the disease in children with normal body weight [6, 7].

The objective of our study was a comparative assessment of the KIM-1 level in urine and other parameters in children with non-glomerular chronic kidney disease (CKD) on a background of obesity and without it. Tasks of the study were to analyze the age and sex composition of sick children with CKD with and without obesity; to analyze the quantity of pyelonephritis exacerbations per year in children with CKD with and without obesity; to conduct a comparative assessment of some biochemical parameters of blood (glucose, ALT, AST, cholesterol, LDL, insulin, creatinine, glomerular filtration rate - GFR) in children with CKD with and without obesity; to conduct a comparative assessment of the KIM-1 marker level in urine in children with CKD with and without obesity.

MATERIALS AND METHODS

56 children with CKD 1-2 stages were examined; in all the children, the a etiology was recurrent pyelonephritis that was based (also in all the children) on a congenital anomaly of kidneys and/or urinary tracts: vesicoureteral reflux, obstruction of urinary tracts (ureteric stricture, metal stenosis), renal hyperplasia. All the patients were divided into two groups, depending on the body weight.

The first group included 29 patients with CKD without obesity, at the age of 3 - 17 y.o. The average age was 11.0 ± 4.1 y.o. This group included 20 girls (69.0 %) and 9 boys (31.0 %). The second group consisted of 27 patients with CKD on a background of obesity, at the age of 5 - 17 y.o. The average age of this group of children was 12.1 ± 3.3 y.o. This group included 13 (48.1 %) girls and 14 (51.9 %) boys. The groups of patients were comparable by sex, age, and etiology of CKD. The 1st group patients' body weight conformed to the age norm, and the 2nd group patients' body weight exceeded the normative values (SDS of BMI > 2). In this group, 10 (37.0 %) of children had first-degree obesity (SDS of BMI > 2 and < 2.5), 10 children (37.0 %) had second-degree obesity (SDS of BMI > 2.5 and < 3), and 7 (25.9 %) of patients had third-degree obesity (SDS of BMI > 3). We compared the quantity of pyelonephritis exacerbations per year in children with CKD with and without obesity. We also compared the parameters of the blood and urine analysis and some parameters of the biochemical blood analysis: glucose, ALT, AST, cholesterol, insulin, low-density lipoproteins (LDL), creatinine; the level of Schwartz glomerular filtration rate (GFR) was calculated. To examine the KIM-1 urinary excretion level, 10 - 20 ml of first void urine was collected in dry plastic test tubes. We measured the optical density value of standard solutions with known KIM-1 concentration and compared it with the optical density of the urine samples that were being examined. The KIM-1 level in the examined urine samples was calculated by plotting a calibration logarithmic curve by means of the STATISTICA 6.0 software.

RESULTS AND DISCUSSION

It was determined that the patients of both groups differed by the frequency of pyelonephritis exacerbations per year. One pyelonephritis exacerbation per year was more frequent in children without obesity: 12 (42.9 %) children, in comparison with 5 (18.5 %) patients with obesity. Two pyelonephritis exacerbations per year were in 11 (40.7 %) patients in the group with obesity and 9 (32.1 %) children in the group without obesity. By the laboratory examination results, it can be noted that the children with obesity had higher erythrocyte level: $4.72 \times 10^{12}/l$. While the value in the children without obesity was $4.5 \times 10^{12}/l$ ($p = 0.028$). The hemoglobin level was 138 g/l and 129 g/l, respectively ($p < 0.05$). ESR was lower in children with obesity: 9 mm/h, in comparison with the children without obesity - 14 mm/h ($p = 0.014$). The other blood and urine parameters of the patients of both groups did not differ. In biochemical blood analysis of the patients with CKD and obesity, we detected the higher levels of glucose, cholesterol, LDL, insulin, ALT, and AST (see Table 1).

Table 1: The levels of glucose, ALT, AST, cholesterol, LDL, and insulin in children with CKD with and without obesity

Biochemical parameters	Without obesity(n=29)	With obesity (n=27)	P
Glucose, mmol/l	4,9±0,6	5,2±0,4	0,025
ALT, nmol/l	13,4±3,5	15,4±4,3	0,002
AST, nmol/l	16,8±4,4	17,6±5,0	0,000003
Cholesterol, mmol/l	2,3±0,6	4,4±0,4	0,05
LDL, mmol/l	2,1±0,5	4,0±0,3	0,0001
Insulin, mmol/l	12,0±4,2	13,7±3,0	0,01

Table 2 demonstrates the values of creatinine and GFR in the different patient groups. It can be seen that the children with CKD and obesity had a sufficiently higher creatinine level, and their Schwarz GFR level was sufficiently lower than in children with CKD without obesity.

Table 2: The levels of serum creatinine and GFR in the children with CKD with and without obesity.

Parameters	Without obesity(n=29)	With obesity (n=27)	P
Serum creatinine, mg%	0,59±0,15	0,71±0,12	0,01
GFRml/min/1,73m ²	137,6±23,7	122,4±19,0	0,0006

Table 3 demonstrates the results of KIM-1 examination in urine in the children with CKD with and without obesity.

Table 3: KIM-1 level in urine in the children with CKD with and without obesity.

Parameter	Without obesity(n=29)	With obesity (n=27)	P
KIM-1, pg/ml	1516,19± 417,87	5824,06± 2591,38	0,033

Table 3 shows that the KIM-1 level in urine was sufficiently higher in patients with CKD and obesity. Table 4 demonstrates that the KIM-1 percentile values in urine were also different in the patients with CKD with and without obesity. KIM-1 values in urine at a level of 75 and 90 percentiles were significantly higher in patients with CKD and obesity (nonparametric Mann-Whitney test, p = 0.0005).

Table 4: Percentile distribution of the KIM-1 values in urine (pg/ml) in children with CKD with and without obesity.

Children with CKD	10th percentile	25thpercentile	Median	75thpercentile	90th percentile
With obesity (n=27)	26,4	381,4	682,1	4059,0	16390,0
Without obesity(n=29)	349,4	527,2	742,3	1211,5	2246,0

CONCLUSIONS

It was determined that the children with CKD on a background of obesity had higher levels of glucose, cholesterol, LDL, ALT, AST, and insulin. In the patients with CKD on a background of obesity, higher creatinine level was detected; the Schwarz glomerular filtration rate was lower in these patients. Two pyelonephritis exacerbations per year were more frequent in the patients with CKD on a background of obesity. The KIM-1 level in urine was significantly higher in the patients with CKD on a background of obesity in comparison with the level in the children with CKD without obesity. Thus, non-glomerular CKD in children with obesity was more adverse and they had a sufficiently higher kidney injury marker level in comparison with the children with CKD on a background of normal body weight.

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