Studying peculiarities of chronic kidney disease in patients with concomitant obesity

M. S. Berezova*, S. O. Akentiev, O. A. Olenovich, A. V. Semeniak

Bukovinian State Medical University, Chernivtsi, Ukraine
*Corresponding author. E-mail: myroslava@bukovynaonline.com

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Abstract. Obesity is considered to be a risk factor for the development and progression of chronic kidney disease. The study involved 48 patients with the 2nd degree chronic kidney disease with and without concomitant obesity. The patients underwent the determination of proteinuria, blood lipid spectrum, they were also measured the glomerular filtration rate and the body mass index. The analysis of clinical and laboratory parameters in the examined patients showed a significant difference between the indices of lipid spectrum of the blood and proteinuria in patients with and without obesity. The presence of obesity may worsen the course of chronic kidney disease.

Keywords: *chronic kidney disease, obesity, hyperlipidemia, lipids.*

Introduction. Recently, much attention is paid to the study of the influence of obesity and overweight on the course of chronic kidney disease. Today, obesity is considered to be one of the most important public health problems. According to the World Health Organization as of 2014 about 2 billion adults are overweight, of whom 670 million are obese.

The negative impact of overweight on renal function is still poorly understood.

Publications review on the subject. According to the hypothesis of lipids nephrotoxicity, hyperlipidemia or dyslipidemia, which may accompany not only obesity, results in a damage to the endothelium of the kidney capillaries and lipid deposits in the mesangium [1, 3,4, 10, 11, 14]. Mesangial cells are able to bind and oxidize low-density lipoproteins, and it will stimulate the proliferation and development of mesangial sclerosis (glomerulosclerosis). Lipoproteins, which are filtered in the kidney glomeruli, are deposited in the renal tubules and are capable of inducing tubulointerstitial processes, interstitial sclerosis and further progression of renal failure [9, 13].

The mechanism of the development of vascular atherosclerosis and vascular nephrosclerotic processes (glomerulosclerosis) are similar: the oxidized lowdensity lipoproteins penetrate through the damaged endothelium of the capillaries of the renal glomeruli, get trapped by the mesangial cells,forming foam cells, around which collagen fibers begin to form [3, 5,15].

Indirectly, obesity will affect the development of diabetes and hypertension, as well as impaired renal hemodynamics. Besides, biologically active substances, hormones and cytokines secreted by adipocytes of the adipose tissue have a negative effect on the renal tissue, [2, 6, 12].

Changes of renal hemodynamics in patients with obesity is manifested by increased glomerular filtration rate and renal plasma flow, that are similar to the processes that develop in the early stages of kidney damage in type 2 diabetes mellitus and hypertension and act as an activation of hemodynamic triggers of nephropathy progression. It is this fact that determines the relevance of studying the characteristics of the course and progression of chronic kidney disease [5, 7, 8].

Objective. To study the features of the course of chronic kidney disease in patients with and without concomitant obesity.

Materials and methods. The study involved 48 patients with stage 2chronic kidney disease (CKD), who were hospitalized in the Nephrology department of "Chernivtsi regional clinical hospital." The average age of the patients was 43.5 ± 1.5 years (from 34 to 62 years). CKD was caused by: chronic pyelonephritis in 19 patients (39.5%), chronic glomerulonephritis in 12 patients (25%), diabetic nephropathy in 17 patients (35.5%). CKD duration ranged from 1 to 17 years (on average 8,9 ± 1,5 years).

All patients were divided into three groups. The first group consisted of patients with 2 stage CKD without concomitant obesity (16 persons), The second group included stage 1 obese patients with stage 2 CKD (17 persons), group 3 consisted of 15 patients with stage 2 CKD and stage 2 concomitant obesity. Body mass index (BMI) was calculated by the formula: BMI = body weight in kg / (height in meters ²). An ideal BMI is considered to be equal 19-24 kg/m² for women and 19-25 kg/m² for men (Adolphe Quetelet, 1869 p.).

According to the classification of obesity (WHO, 2000) all the patients who were under study were divided into the following groups: non-obese patients – 16 people (33.3%), patients with I degree obesity – 17 persons (35.4%) and patients with II degree obesity – 15 people (31.25%). The control group included 19 healthy individuals. The patients in all groups were divided according to their age and sex. The renal function was assessed by determining the glomerular filtration rate (GFR) by the MDRD formula. Glomerular filtration rate in all patients was 90 ml/min – 60 ml/min, which, according to the classification adopted at the 2nd Congress of Nephrologists of Ukraine (2005) corresponds to stage 2 CKD. All the studied patients with chronic kidney disease were determined the level of microalbuminuria, total cholesterol (TC), triglycerides (TG), cholesterol, high-density lipoprotein (HDL) cholesterol and lowdensity lipoprotein (LDL). Inclusion criteria were: 90 GFR ml/min – 60 ml/min. Statistical data processing was carried out using the statistical software "Excel 5.0" by finding the mean value, standard deviation and the confidence interval. For the reliability of differences between the groups we applied Student factor (t). Differences between groups were recognized reliable at a significance level of $p < 0.05$. The study was carried out in accordance with the ethical standards of the Helsinki Declaration of 2008.

Results and discussion. An analysis of renal function in the evaluation of patients with the second degree CKD and without concomitant obesity as compared with the healthy subjects showed the presence of proteinuria and deterioration of glomerular filtration rate ($p < 0.05$) (Table 1). However, in the groups of patients with obesity these figures as compared with the patients without conco-mitant obesity were reliably lower ($p < 0.05$) and were dependent on the degree of obesity. Patients of group 1 had the following values of the renal function: the level of microalbuminuria – 564 ± 12.5 mg/L, GFR – 81 ± 6,7 ml/min /1.73 m2; the figures in the second group of patients were: the level of microalbuminuria – 853 ± 14.7 mg/L, GFR – 74 ± 5,2 ml/min/1.73 m2; Patients in group 3: the level of microalbuminuria – 968 ± 19,4 mg/L, GFR – 65 ± 4,7 ml/min/1.73 m2.

Table 1. Characteristic of the kidney function values, depending on the body mass index in patients with the second degree chronic kidney disease (M ± m, n)

Values	Group of practically healthy individuals n = 19	Group 1 n = 16	Group 2 n=17	Group 3 n = 15
Age	46,8 ± 6,1	39,7 ± 5,4	46,3 ± 4,7	59,5 ± 5,9
Microalbuminuria, mg/l	55 ± 17,2	564 ± 12,5*	853 ± 14,7*^	968 ± 19,4*^
Glomerular filtration rate, mL/min/1.73 m²	94 ± 5,1	81 ± 6,7*	74 ± 5,2*^	65 ± 4,7*^
Note: * – $p < 0,05$ compared to the values in the control group; ^ – $p < 0,05$ compared to the group of non-obese patients.				

While studying the blood lipid spectrum indices, we identified impaired lipid serum metabolism as a reliable increase in levels of TC, triglycerides and LDL cholesterol due to lower HDL-C in patients with CKD and without obesity compared with healthy individuals ($p < 0.05$) (Table 2).

Moreover, in patients with concomitant obesity the most pronounced imbalance in lipid metabolism was observed in II degree obese patients ($p < 0.05$). In non-obese patients with the second degree CKD the level of total cholesterol was 6,55 ± 0,32 mmol/l, TG – 2,23 ± 0,44 mmol/l, LDL – 4,53 ± 0,76 mmol/l , HDL – 1,12 ± 0,37 mmol/l. The patients of the second group had the level of TC 6,04 ± 0,54 mmol/l, TG – 2,39 ± 0,45 mmol/l, LDL – 4,78 ± 0,13 mmol/l and HDL cholesterol levels – 0.75 ± 0.24 mmol/l. The values of the lipid profile in patients of the third group were as follows: total cholesterol level was 7,29 ± 0.26 mmol/L, TG – 3,62 ± 0,24 mmol/l, LDL – 5,13 ± 0,77 mmol/l and HDL cholesterol level – 0,72 ± 0,65 mmol/l.

Table 2. Characteristic parameters of lipid metabolism in patients with stage 2 chronic kidney disease (M ± m, n)

Values	Group of practically healthy individuals n = 19	Group 1 n = 16	Group2 n = 17	Group3 n = 15
TC, mmol/l	3,33 ± 0,25	6,55 ± 0,32*	6,04 ± 0,54*	7,29 ± 0.26*+
TG, mmol/l	1,27 ± 0,74	2,23 ± 0,44	2,39 ± 0,45*	3,62 ± 0,24+
LDL-C, mmol/l	2,55 ± 0,58	4,53 ± 0,76*	4,78 ± 0,13*	5,13 ± 0,77*+
HDL-C, mmol/l	1,44 ± 0,84	1,12 ± 0,37*	0,75 ± 0,24*	0,72 ± 0,65*+
Note: * $p < 0,05$ – compared to the values in the control group; + $p < 0,05$ – compared to the group of non-obese patients.				

The findings suggest that patients with the second degree CKD and concomitant obesity were observed a blood lipid imbalance which is more pronounced in patients with II degree obesity. The parameters of the renal function in these patients were reliably lower compared with those in the group of patients without a concomitant obesity.

Conclusions. The analysis of clinical and laboratory parameters revealed the presence of an imbalance in fat metabolism in obese and non-obese patients with chronic kidney disease. However, the changes in patients with II degree obesity were more significant. In this same group the patients showed a more pronounced impairment of renal function, indicating a more severe course of disease in obese patients. It means that this variant of the disease is more unfavorable.

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Аннотация. Ожирение рассматривается как фактор риска развития и прогрессирования хронической болезни почек. Обследовано 48 больных с хронической болезнью почек 2 степени с и без сопутствующего ожирения. Пациентам проводили определение протеинурии, показателей липидного спектра крови, определяли скорость клубочковой фильтрации и индекс массы тела. Анализ клинико-лабораторных показателей обследованных пациентов показал достоверную разницу между показателями липидного спектра крови и протеинурии в группах пациентов с наличием ожирения и без. Наличие ожирения может ухудшить течение хронического заболевания почек.

Ключевые слова: *хроническая болезнь почек, ожирение, дислипидемия, липиды.*