

## Age characteristics of lipid imbalance in the blood of patients with diabetic nephropathy and arterial hypertension

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Paper received 12.08.2016; Accepted for publication 25.08.2016.

**Abstract.** Age and gender characteristics of blood lipid imbalance in patients with diabetic nephropathy of IV stage and hypertension against the ground of type 2 diabetes mellitus were established. The intensity of lipid imbalance in patients was found to depend not only on the age of chronic kidney disease and degree of hypertension but also on their age and sex.

**Keywords:** *diabetic nephropathy, hypertension, lipid imbalance, chronic kidney disease.*

**Introduction.** One of the most serious microvascular complications of diabetes mellitus (DM) is diabetic nephropathy (DN). The occurrence of diabetic nephropathy in case of type 2 diabetes mellitus is 55%. Renal lesions occurring in case of DM causes or intensifies development of arterial hypertension accelerating continuous progress of pathology and finally results in the development of chronic kidney failure [2, 5, 7, 10].

The study of factors promoting the progress of DN is an important problem today. Dyslipidemia is one of the risk factors of DN development [1, 2]. Low-density lipoproteins (LDLP) are conjugated and oxidized by mesangial cells stimulating proliferation of mesangium and development of glomerulosclerosis. In addition, lipoproteins filtrated in the glomeruli, accumulate in the tubules and induce tubular-interstitial processes, interstitial sclerosis, causing progress of chronic kidney disease (CKD) and development of kidney failure [1, 3, 4, 6, 8].

Diabetic lipid profile is a result of an increased level of free fatty acids due to resistance of adipose cells (lipocytes) to insulin. Excess of free fatty acids is transformed in the liver into triglycerides (TG), their increased amount stimulates production of very low-density lipoproteins and apolipoprotein [9, 12, 13]. Therefore, diabetic dyslipidemia is characterized by an increased concentration of TG, LDLP cholesterol and decreased concentration of HDLP cholesterol. Although, in patients with DM severity of lipid metabolism disorders is not similar and it depends on many factors beginning with age and ending with comorbid pathology [11, 14].

**The aim of the research.** To study age and gender peculiarities of lipid imbalance in the blood in patients with diabetic nephropathy and comorbid arterial hypertension.

**Material and methods.** 84 patients with type 2 diabetes mellitus aged from 47 to 75 with the duration of the disease for 10-15 years were examined at the Department of Nephrology of the Regional Clinical Hospital of Chernivtsi. All the patients were distributed between two groups: I group included 43 patients with CKD I degree and DN IV degree, II group included 41 patients with CKD II degree and DN IV degree. Every group was divided into subgroups (with arterial hypertension (AH) I and II degree). The control group included 19 practically healthy individuals. Patients in all the groups were distributed according to the age and sex. Total cholesterol (TCS), triglycerides (TG), high density lipoproteins (HDLP), low density lipoproteins (LDLP) in the blood plasma were detected in all the patients by

means of common methods. The criteria of including into the study were:  $HbA1c \geq 7,0\%$ ,  $TCS \geq 5,0$  mmol/L,  $LDLP \geq 3,0$  mmol/L;  $TG > 1,77$  mmol/L;  $HDLP < 1,2$  mmol/L. The data obtained were statistically processed by means of statistical programs „Excel5.0” with the calculation of mean value and standard deviation. Student's t-test was used to detect difference probability between the groups. Differences between the groups were considered to be reliable with the significance level  $p < 0,05$ . Mann-Whitney criterion was used for non-parametric calculations. The study was conducted according to ethic norms stipulated by the Helsinki Declaration of 2008.

**The results and their discussion.** The analysis of clinical-laboratory findings of the patients examined resulted in the detection of disorders of lipid metabolism in the blood serum in the form of reliable increase of the levels of TCS ( $p < 0,05$ ), TG and LDLP respectively ( $p < 0,05$ ) against the ground of decreased level of HDLP as compared with the findings of practically healthy individuals (Table 1). At the same time, the most severe imbalance of lipid metabolism was found in patients with DN having CKD II degree and AH II degree.

Gender distribution in the groups of patients demonstrated that more severe lipid imbalance was found among women than among men. A considerable increase of LDLP was shown to be found both among men and women with DN against CKD II degree ( $p < 0,05$ ). Therefore, a considerable lipid imbalance in patients with DN against CKD I-II degrees and AH II degree was found among all the patients with a probable gender difference specially in case of CKD II degree (Table 1).

To our opinion, obtained gender differences can be explained by the fact that lipid profile of women during all their life undergoes changes. It is connected with the influence of endogenic hormones during pregnancy, intake of oral contraceptives, and the effect of estrogens. Therefore, the risk of occurrence of various complications in women, even with similar values of lipid spectrum with men, is rather low. Although, this regularity after the age of 60 decreases, especially in case of DM.

According to the age category the patients examined were distributed into two age groups: I group – patients of a mature age (45-65 years) and II group – patients with DN against the ground of CKD I-II degree of an elderly age over 65 (V. Quinn classification, 2000). The results are analyzed in Table 2.

Thus, the analysis of the obtained results found that the values of lipid metabolism differed most substantially in persons of an elderly age as compared with the results of

**Table 1.** Clinical-laboratory characteristics of patients with DN IV degree against CKD I-II degree and AH II degree according to gender distribution (M ± m, n)

Indices		Age (years)	GFR (ml/min.)	TCS(mmol/l)	TG (mmol/l)	LDLP (mmol/l)	HDLP (mmol/l)	
Healthy (n = 19)	Men	56,8 ± 6,91	140,21 ± 6,91	3,3 ± 0,34	1,29 ± 0,8	2,45 ± 0,8	1,44 ± 0,3	
	Women	57,4 ± 6,23	125,22 ± 4,81	3,8 ± 0,69	1,78 ± 0,79	2,54 ± 0,65	1,56 ± 0,45	
I group (n = 43)	Ah I st. (n = 22)	Men	57,9 ± 6,21	141,33 ± 0,24	6,23 ± 0,41*	2,11 ± 0,35	3,71 ± 0,21*	1,08 ± 0,17*
		Women	57,5 ± 6,29	127,11 ± 3,21	6,98 ± 0,72*	2,20 ± 0,12	3,98 ± 0,24*	1,03 ± 0,12*
	Ah II cr. (n = 21)	Men	56,7 ± 6,24	148,92 ± 4,13	6,78 ± 0,71*	2,82 ± 0,41*	3,78 ± 0,23*	0,87 ± 0,24*
		Women	58,9 ± 6,32	145,12 ± 4,34*	7,48 ± 0,62*	3,05 ± 0,27*	4,49 ± 0,44*	0,71 ± 0,05**
II group (n = 41)	Ah I st. (n = 22)	Men	58,1 ± 6,39	71,34 ± 5,11*	6,99 ± 0,52*	3,02 ± 0,37*	3,79 ± 0,29*	0,97 ± 0,08*
		Women	57,9 ± 6,11	68,24 ± 5,12**	7,99 ± 0,32*	3,71 ± 0,27**	4,98 ± 0,22*	0,67 ± 0,09*
	Ah II st. (n = 19)	Men	58,4 ± 5,71	88,91 ± 9,33**	8,25 ± 0,31**	3,61 ± 0,44**	4,47 ± 0,33**	0,74 ± 0,05*
		Women	57,6 ± 6,10	82,67 ± 3,65**	8,88 ± 0,33**	3,94 ± 0,57**	5,99 ± 0,44**	0,65 ± 0,04**

Note to the table: \* p < 0,05 – compared with healthy individuals ;  
 \*\* p < 0,05 compared with I group concerning sex.

**Table2.** Clinical-laboratory characteristics of patients with DN IV degree against CKD I-II degree and AH II degree according to age distribution (M ± m, n)

Indices		GFR (ml/min.)	TCS (mmol/l)	TG (mmol/l)	LDLP (mmol/l)	HDLP (mmol/l)	
Healthy (n=19)	matureage	110,51 ± 5,67	3,4 ± 0,34	1,28 ± 0,84	2,45 ± 0,67	1,43 ± 0,74	
	elderlyage	92,21 ± 4,81	3,9 ± 0,89	1,26 ± 0,54	2,44 ± 0,46	1,57 ± 0,43	
I group (n = 43)	Ah I st. (n = 22)	matureage	120,33 ± 0,22*	6,45 ± 0,42*	2,13 ± 0,45	4,43 ± 0,67*	1,05 ± 0,67*
		elderlyage	92,79 ± 3,25	6,02 ± 0,65*	3,41 ± 0,76*	5,12 ± 0,76*	0,92 ± 0,56*
	Ah II cr. (n = 21)	matureage	138,92 ± 3,13*	6,78 ± 0,71*	2,46 ± 0,45	4,16 ± 0,23*	0,93 ± 0,24*
		elderlyage	95,12 ± 4,31*	6,74 ± 0,55*	3,52 ± 0,37*	5,23 ± 0,35*	0,81 ± 0,53*
II group (n = 41)	Ah I st. (n = 22)	matureage	85,38 ± 5,14*	7,19 ± 0,36**	3,12 ± 0,34*	4,59 ± 0,19*	0,87 ± 0,05*
		elderlyage	78,24 ± 5,12**	8,79 ± 0,34**	3,81 ± 0,34*	5,49 ± 0,28*	0,67 ± 0,09**
	Ah II st. (n = 19)	matureage	78,93 ± 9,32**	8,47 ± 0,33**	3,71 ± 0,54**	5,47 ± 0,33**	0,78 ± 0,04**
		elderlyage	79,47 ± 3,25**	8,97 ± 0,32**	3,99 ± 0,51**	6,09 ± 0,47**	0,66 ± 0,03**

Note to the table: \* p < 0,05 – compared with healthy individuals;  
 \*\* p < 0,05 – compared with I group concerning the age.

of patients of a mature age, and they depend more considerably on the stage of CKD than the degree of AH, although in elderly patients the values differ considerably according to the degree of AH. Therefore, the values of TCS were considerably high in all the group of patients in comparison with appropriate values of healthy individuals (p < 0,05), but it should be noted that in patients with CKD II degree and AH II degree the levels of TCS were reliably higher than in patients with CKD I degree and AH I and II degrees (according to the comparison in the age groups (p < 0,05)). The content of TG and LDLP was also

considerably increased in patients with CKD II degree and AH II degree in comparison with other groups of the study (p < 0,05). The level of HDLP decreased in all the patients with DN against the ground of CKD I-II degrees (p < 0,05), but it was the lowest in all the patients with CKD II degree with AH I and II degrees.

Therefore, the study conducted has demonstrated the availability and occurrence of lipid imbalance in the examined patients and the dependence of the progress of this imbalance, not only on the stage of CKD and degree of AH, but on the age and sex of patients.

**Conclusions:**

1. Considerable gender differences of lipid imbalance are found in patients with DN IV degree against the ground of CKD I-II degree and AH II degree with their prevailing among women.
2. Lipid imbalance is most pronounced in patients with DN IV degree against the ground of CKD I-II degrees

with AH II degree of elderly patients which is revealed by a considerable increase of LDLP level.

3. A considerable increase of the levels of TCS, LDLP, TG and decrease level of LDLP is found in comparison with patients with DN IV degree against the ground of CKD I degree with AH I degree.

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**Возрастная характеристика дисбаланса липидов крови пациентов с диабетической нефропатией и артериальной гипертензией**

**Л. А. Зуб, С. Д. Новиченко**

**Аннотация.** Изучено возрастные и гендерные особенности дисбаланса липидов крови у больных с диабетической нефропатией IV стадии с наличием сахарного диабета 2 типа и артериальной гипертензии. Установлено, что выраженность дисбаланса липидов у больных зависела не только от стадии хронической болезни почек и степени артериальной гипертензии, но и от возраста и пола пациентов.

**Ключевые слова:** хроническая болезнь почек, диабетическая нефропатия, гипертензия, дисбаланс липидов.