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Influence of dyslipidemia in patients with diabetes mellitus type 2 and essential hypertension

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Abstract
The aim of this work is to study the changes in blood lipid profile in relation to the level of glycated hemoglobin (HbA_1C) in patients with diabetes mellitus type 2 and essential hypertension.
Materials and Methods: Examined were 48 patients with diabetes mellitus type 2, made up of 22 patients with diabetes mellitus type 2 without essential hypertension and 26 patients with diabetes mellitus type 2 and concomitant medication-compensated essential hypertension. Determinations of total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides and HbA_1C levels were carried out.
Results: More severe dyslipidemia (and a higher risk of cardiovascular disease) was found in patients with diabetes mellitus type 2 and concomitant essential hypertension. Correlated relationship between blood lipid profile level and the average level of HbA_1C was established.
Conclusion: The adverse effects of dyslipidemia on the clinical course of diabetes mellitus type 2 and essential hypertension were established.

Keywords: Dyslipidemia, diabetes mellitus, essential hypertension, glycated hemoglobin.

1. Introduction
Diabetes mellitus type 2 is a multicomponent disease and in most cases accompanied by dyslipidemia, which is a risk factor for cardiovascular disease [5, 8]. Diabetes is now ranked third in the overall morbidity and mortality after cardiovascular disease and cancer. According to the World Health Organization, its estimated prevalence will increase to 300 million patients in 2025 [2, 9].
Prevalence of essential hypertension in patients with diabetes mellitus type 2 is 2-3 times higher than in the general population, and increased blood pressure in 70% of patients with diabetes mellitus type 2 significantly increases the risk of cardiovascular complications that worsen the prognosis and quality of life of patients and is one of the main causes of mortality.
The combination of essential hypertension and diabetes mellitus type 2 is accompanied by a significant increase in the risk of complications such as stroke, coronary artery disease (CAD), congestive heart failure and atherosclerosis. In diabetes mellitus type 2 combined with essential hypertension and coronary artery disease, the risk of stroke is increased 2-3 times, kidney failure by 15-20 times [4-7]. Atherosclerosis in diabetes mellitus type 2 is characterized by early development, widespread nature of vascular lesions and crueler course. Accelerated atheroma formation in diabetes mellitus type 2 is associated with contributing factors such as dyslipidemia and insulin resistance [1, 3, 4].
With a view to early diagnosis of diabetes mellitus type 2 and treatment quality assessment, the determination of the level of glycated proteins is used. Among them and of significant clinical importance is the level of glycated hemoglobin. Glycated hemoglobin is a compound of hemoglobin and glucose. Level of glycated hemoglobin depends on the compensation of carbohydrate metabolism and indicates the glucose level in the red blood cells (RBCs) during the period of RBC life which is 120 days. Considered normal HbA_1C level is within 4.0 – 5.9% [1, 5].
However, it remains poorly understood the relationship between the indices of blood lipid profile, blood pressure (BP) and HbA_1C levels in the blood of patients with diabetes mellitus type 2 and concomitant essential hypertension.
The aim of this work is to study the changes in blood lipid profile in relation to the level of glycated hemoglobin in patients with diabetes mellitus type 2 and essential hypertension.

2. Materials and Methods of Investigation

The study involved 48 patients with diabetes mellitus type 2 among whom were 27 females and 21 males, the average age being (58.2 ± 5.1) years. All patients were divided into two groups: 22 patients with diabetes mellitus type 2 without essential hypertension (group I) and 26 patients with diabetes mellitus type 2 and concomitant medication-compensated essential hypertension - BP: systolic (SBP) 146.3 ± 9.1 mm Hg, diastolic (DBP) 92.4 ± 4.7 mm Hg (group II). The control group consisted of 20 healthy volunteers. The groups were randomized based on age, sex and body mass index.

In all patients was performed general clinical examination, biochemical blood test to determine the levels of total cholesterol, triglycerides (TG), low density lipoprotein (LDL), high density lipoprotein (HDL) and glycated hemoglobin (HbA_1C). HbA_1C level was determined by automatic analyzer D-10 (US). Biochemical Analyzer BA-88 (China) was used to determine microalbuminuria. Laboratory tests were performed according to the recommendations of manufacturers of diagnostic test kits in the laboratory using modern technologies.

Statistical analysis of the results of research was carried out by a computer program Microsoft Excel, "Statistica 10 Enterprise x64" ("Stat Soft", USA) using methods of variation statistics, t-Student's test, Wilcoxon test, paired factor correlation analysis and Pierson correlation coefficient determination.

3. The Received Results and their Discussion

Analysis of the results of the study revealed orientation towards atherogenic lipid profile in the blood of patients. More pronounced changes were found in patients with DM type 2 and essential hypertension (Table 1). In particular, in group II patients, increased total cholesterol content was 6.67 ± 0.43 mmol/L ($p<0.05$) compared with healthy volunteers and exceeded that of group I patients by up to 18.68% ($p<0.05$).

The level of TG in group II patients was 2.68 ± 0.21 mmol/L ($p<0.05$) compared with healthy volunteers and was increased by up to 20.17% when compared to the group I patients ($p<0.05$).

Value of LDL in group II was 3.85 ± 0.29 mmol/L and was higher than that of patients in group I by up to 22.61% ($p<0.05$).

Content of anti-atherogenic HDL was reduced and amounted to 1.13 ± 0.08 mmol/L ($p<0.05$) compared with healthy volunteers and lower in patients from group II by up to 13.7% ($p<0.05$).

More pronounced dyslipidemia in group II patients may be associated with an additional factor in the defect of the vascular wall. In terms of lipid profile, group II patients are at high risk of cardiovascular disease on the criteria of European Diabetes Policy Group set to 76.92% as moderate in 23.08% of cases; patients and groups - to 45.46% and 54.54% respectively ($p<0.05$).

The level of HbA_1C in group II patients was (9.21 ± 0.38)%, in group I patients (7.81 ± 0.35)% ($p<0.05$).

As a result of studying the correlation relationships between HbA_1C levels and lipid profile indices, the following correlations were found: between HbA_1C levels and total cholesterol content exists a direct correlation of medium strength (r = + 0.49, $p<0.05$); between HbA_1C levels and triglycerides - (r = + 0.59, $p<0.05$); between HbA_1C level and LDL - (r = + 0.55, $p<0.05$) and between HbA_1C levels and HDL levels was the presence of inverse correlation of medium strength (r = -0.58, $p<0.05$), indicating mutually burdening effect on decompensation between DM type 2 and dyslipidemia. The influence of indices of dyslipidemia on the value of SBP is in contrast to the DBP, the correlation between the content of total cholesterol, LDL, TG and SBP constituted (r = + 0.41; +0.49; +0.52 respectively, $p<0.05$) (Table 2).

Table 1: Index of lipid profile in patients with diabetes mellitus type 2 and essential hypertension, M ± m

Index	Healthy volunteers, n=20	Group I patients, n=22	Group II patients, n=26
Total cholesterol (mmol/L)	4,26 ± 0,38	5,62 ± 0,35	6,67±0,43*•
HDL (mmol/L)	1,61 ± 0,35	1,31 ± 0,24	1,13 ± 0,08*•
LDL (mmol/L)	2,27 ± 0,16	3,14 ± 0,43*	3,85 ± 0,29*•
Triglycerides (mmol/L)	1,35 ± 0,12	2,23 ± 0,36*	2,68 ± 0,21*•

Notes: * - significant differences from healthy, p <0.05;
• - reliability of index differences in group I and II patients

Table 2: Correlation between index result of lipid profile, glycated hemoglobin, blood pressure and microalbuminuria in patients with diabetes mellitus type 2 and essential hypertension

Index	HbA_1C (%)	BP (mmHg)
Total cholesterol (mmol/L)	+0,49*	+0,41*
LDL (mmol/L)	+0,55*	+0,49*
Triglycerides (mmol/L)	+0,59*	+0,52*

Note: * - significant correlation, p <0.05

4. Conclusion

1. In patients with diabetes mellitus type 2 and concomitant essential hypertension, there is more severe dyslipidemia and a higher risk of cardiovascular disease.
2. The studied relationship between lipid profile levels, HbA_1C levels and the SBP values shows the adverse effects of dyslipidemia on the clinical course of diabetes mellitus type 2 with essential hypertension comorbidity. Further scientific research is expedient to direct the study of disorders of carbohydrate and lipid metabolism in patients with diabetes mellitus type 2 and essential hypertension to the level of kidney function.

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