

Features of the lipid metabolism in patients with hypertension and overweight

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Abstract: The recent interest in lipid metabolism in hypertension increased significantly, due to a focus on the pathophysiology of fat metabolism in obesity, diabetes and related conditions such as hypertension. So, the aim of this study was to identify the characteristics of lipid and carbohydrate metabolism in hypertensive patients combined with overweight. The study involved 55 hypertension patients. There were examined 19 people in control group with normal blood pressure, no carbohydrate metabolism disorders, and other chronic comorbidities. Fasting insulin concentrations in serum were determined by ELISA. Fasting glucose was performed by glucose oxidase method. The level of total cholesterol, triglycerides, high-density lipoprotein, low density lipoprotein cholesterol was determined in serum by photolorimetric method. The hypertensive patients compared with the control group have got higher levels of systolic and diastolic blood pressure. In addition, the body mass index, hips, waist ratio, levels of total cholesterol, very low density lipoprotein cholesterol, triglycerides and index of atherogenic were elevated in patients with hypertension, which was accompanied by an increase in overweight. Consequently, the lipid metabolism disorders in hypertensive patients were earlier than the metabolic abnormalities of glucose and accompanied with overweight.

Key words: hypertension, overweight, lipid metabolism, carbohydrate metabolism.

Introduction

The current strategy modification of cardiovascular risk pays great attention to the state of lipid metabolism, the nature of dyslipidemia and relationship between metabolic disorders and adipokine levels. The relationship between

makers and predictors of lipid metabolic disorders for the development of atherosclerosis, also have been increasing the level of blood pressure (BP)¹.

The nature of dyslipoproteinemia, cardiac lipoprotein metabolism disorders and regulation of BP play an important role in the pathogenesis of atherosclerosis. In the initial stages of the pathogenesis of these diseases apolipoproteins are involved in the disease process. What contributes to a variety of pathogenic mechanisms, including the deposition of lipids in the arterial wall and the formation of atherosclerotic plaque, the activation of local and systemic inflammatory mechanisms involved in the development of atherosclerosis, as well as the manifestation of focal and systemic endothelial dysfunction². From this point of view, the content apoprotein-B (apo-B) can be considered as an indicator of the severity of atherosclerosis, and the object of therapeutic interventions and apolipoprotein (apo-A-1) index of antiatherogenic (IA) properties of plasma³ and predictor of cardiovascular risk. Expression of apo-A in hypertensive patients significantly increases the risk of chronic coronary heart disease and unstable angina⁴.

Recently, interest in the lipid metabolism of hypertension increased significantly, due to a focus on the pathophysiology of fat metabolism in obesity, diabetes and related conditions such as hypertension⁵.

Materials and Methods

Thus, in order were to identify the characteristic of lipid and carbohydrate metabolism in hypertensive patients combined with overweight. The study involved 77 hypertension patients (systolic blood pressure (SBP) > 140 and diastolic blood pressure (DBP) > 85 mm Hg), which of 28 men and 27 women

¹ Gustafson B. Adipose tissue, inflammation and atherosclerosis / B. Gustafson // J. Atheroscler. Thromb. – 2010. – Vol. 17. – P.332-341

² Коноплева Л.Ф. Эндотелиальная дисфункция в патогенезе сердечно-сосудистых заболеваний и методы ее коррекции / Л.Ф. Коноплева // Therapia. – 2011. - №3 (56). – с.26-30

³ Dullo A.G. Body composition, inflammation and thermogenesis in pathways to obesity and the metabolic syndrome: an overview / A.G. Dullo, S.P. Montani S.P. // Obesity Review. – 2012. – Vol. 13.- Suppl. 2. – P. 1-5

⁴ Паньків В.І. Інсулінорезистентність як ключовий патофізіологічний механізм розвитку метаболічного синдрому / В.І. Паньків // Парактична ангіологія. – 2012. - №5-6 (54-55). – с.24-28

⁵ Біловол О.М. Ожиріння в практиці кардіолога та ендокринолога / О.М. Біловол, О.М. Ковальова, С.С. Попова, О.Б. Тверетінов // Тернопіль ТДМУ “Укрмедкнига”. - 2009. - 619 с.

aged 29 to 74 years. The control group was examined of 19 people with normal BP, no carbohydrate metabolism disorders, and other chronic comorbidities.

BP was assessed by the average BP obtained from the three measurements in 2 - minute intervals in the sitting position. Calculation for body mass index (BMI), hips ratio (HR), waist ratio (WR) and for determination of insulin resistance (IR) was used Homeostasis Model of Assessment - Insulin Resistance (HOMA-IR). Waist/hip ratio (WR/HR) was calculated for each subject.

Determination of fasting glucose was performed by glucose oxidase method, the analyzer «Humolizer» (Germany). The level of total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL), low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) were determined in our biochemistry laboratory, using standard methods. Results are presented as mean \pm standard deviation from the mean ($M \pm SE$). Reliability of the results calculated with a paired two-sample test using the Student t-test. Considered statistically significant differences at $p \leq 0.05$.

Results

The level of SBP was ($142,6 \pm 4,8$) mm Hg and DBP ($86,4 \pm 5,3$) mm Hg in hypertensive patients ($p < 0.0001$). The height of hypertensive patients was ($1,72 \pm 3,8$) cm (in control $1,7 \pm 4,2$) cm and a weight of ($86,4 \pm 4,8$) kg in the control group ($74,0 \pm 2,1$) kg. Thus, overweight of hypertensive patients was 16.8%, and, in general, the group had a BMI ($28,6 \pm 2,4$) kg, which was significantly higher than controls ($25,7 \pm 2,9$) kg to 25.2% ($p = 0.005$). Volume of hips was increased by 16.6% i.e. occurred predominantly androgenic type of obesity. For hemodynamic features anthropometric data were collected (Table 1).

Table 1.

Hemodynamic features and anthropometric data examined in patients, ($M \pm SE$)

Data				
	Control group	Hypertensive patients	t	p

n	19	55	-	-
SBP (mm Hg)	122,7±4.9	142,6±4,8	8,71	<0,0001
BW (kg)	74,0±4,2	86,4±4,8	4,22	0,00008
Height (cm)	1,70±4,2	1,72±4,8	0,83	0,40
BMI (kg/M2)	25,7±1,8	28,6±2,4	2,89	0,005
WR (cm)	78,1±3,4	97,8±5,6	4,75	0,000012
HR (cm)	97,0±4,2	112,1±4,9	3,01	0,003
WR/HR	0,86±0,02	0,80±0,04	1,45	0,15

Note:

p - significance of differences compared to the control group

t - Student t-test.

Total cholesterol levels in hypertensive patients was ($4,94 \pm 0,60$) mmol / ml, and slightly higher than the control group - ($4,9 \pm 0,58$) mmol / ml, while triglycerides were ($1,54 \pm 0,69$) mmol / ml, very low density lipoproteins (VLDL-C) ($0,63 \pm 0,12$) mmol / ml in controls ($0,37 \pm 0,21$) mmol / ml ($p = 0.01$) and HDL ($1,39 \pm 0,42$) mmol / ml in the control group ($1,34 \pm 0,28$) mmol / ml ($p = 0.74$). Thus, the nature of dyslipidemia (DLP) exhibit hypertriglyceridemia and increased VLDL-C fraction were collected (Table 2).

Table 2.

Features of lipid metabolism examined in patients, (M ± SE)

Data				
	Control group	Hypertensive patients	t	p
n	19	55	-	-
VLDL-C (mmol/ml)	0,37±0,21	0,63±0,12	2,59	0,01
TG (mmol/ml)	0,84±0,04	1,45±0,06	2,59	0,012
TC (mmol/ml)	4,90±0,58	4,94±0,60	0,20	0,84

IA	0,84±0,04	1,45±0,07	2,59	0,012
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Note:

p - significance of differences compared to the control group

t - Student t-test.

From 77 hypertensive patients (BMI less than 24.9% of the proper performance was set at 14.5%), between 25 - 29.9% kg/m² - in 49.1% the second degree of obesity (30 - 34.9%) – 40.7%, and the third degree of obesity - 3.6%. At that time, the first degree of obesity for men was present in - 40.7% and women - 57.1%. For the rest one BMI was 24.9 which of 14.8% for women and 25% for men, and within 25-29,4% BMI in men was observed in 57.1% of women and 40.7% of that the vast majority of patients 63.6% had a BMI of 29.9 kg/m².

From 77 patients with DLP 11.7% BMI was 24.9 kg/m², 25-29.9 kg/m² - 19.5% for obesity degree I 63.6% and obesity degree II 5.2% of patients DLP occurred more frequently in males - 61.0% and was mainly for obesity degree I 59.5%.

The values which characterize the carbohydrate metabolism are mentioned in Table 3. In hypertensive patients fasting glucose was (5,2 ± 0,39) mmol / ml insulin (10,9 ± 1,25) mU / ml and HOMA - IR (2,5 ± 0,37) and were slightly elevated, not significantly different from the level of control subjects.

The presence of IR was found in 32 patients, of which up to a BMI of 29.9 kg/m² - at 5.8%, with a BMI of 25.0-29.9 kg/m² - at 27.9%, obesity degree I - 50.0%, obesity degree II - 11.5% and obesity degree III - 5.8%.

Table 3.

Carbohydrate metabolism examined in patients, (M ± SE)

Data				
	Control group	Hypertensive patients	t	p
n	19	55	-	-
Fasting glucose	4,98±0,71	5,21±0,69	1,70	0,40

(mmol/ml)				
Insulin (mU/ml)	10,08±1,23	10,89±1,67	1,74	0,40
HOMA - IR	2,23±0,07	2,52±0,08	2,60	0,27

Note:

p - significance of differences compared to the control group

t - Student t-test.

IR was occurred in 19 women and 13 men. Women with a BMI of 29.9 kg/m² it was occurred in 6.3%, with a BMI of 25.0 to 29.9 kg/m² - 28.1%, obesity degree I - 50%, degree II – 10.9% and degree III - 4.7%. In men, pattern IR was similar, with a BMI kg/m² to 24.9%, it occurred in 5.0%, 25.0 - 29.9 kg/m² - in 25%, obesity degree I 50%, degree II -12.5%, and degree III - 7.5%. Diabetes mellitus type 2 was observed in 8 patients (5 men and 3 women), and its distribution by groups corresponded IR. The largest group consisted of patients with obesity degree I and II.

Conclusion

In conclusion, the level of SBP and DBP: 16.2% and 15.8% in hypertensive patients were higher than in the control group. Also, hypertension values were elevated with BMI of 11.3%, HR of 15.6%, WR of 25.2%, the level of VLDL of 70.3%, TG of 72.6% and IA of 72.6% were with overweight by 11.3%. In comparison with carbohydrate metabolism parameters such as fasting glucose, level insulin and HOMA-IR were higher but in time were within the normal range. Consequently, the lipid metabolism disorders in hypertensive patients were earlier than the abnormalities glucose metabolism and accompanied with overweight.

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