Journal of science
Lyon

№66/2025

№66 2025

Journal of science. Lyon

ISSN 3475-3281

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MEDICAL SCIENCES

FEATURES OF THE CLINICAL COURSE OF ARTERIAL HYPERTENSION AND LIPID METABOLISM IN PATIENTS WITH CONCOMITANT TYPE 2 DIABETES MELLITUS AND OBESITY

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https://doi.org/10.5281/zenodo.15584651

Abstract

The article investigates the clinical course of arterial hypertension (AH) in patients with concomitant type 2 diabetes mellitus (T2DM) and obesity (OB), with a focus on lipid metabolism indicators. A total of 111 patients were examined and divided into four groups depending on the combination of comorbid conditions. The study revealed that patients with AH combined with T2DM and/or OB exhibit more pronounced disorders of lipid metabolism, particularly elevated levels of total cholesterol and triglycerides. Statistically significant correlations were identified between systolic blood pressure and lipid profile components, including total cholesterol, low-density lipoproteins, and triglycerides. These findings highlight the importance of including lipid profile monitoring and correction in the comprehensive management of patients with hypertension and comorbid metabolic disorders. The study emphasizes the role of dyslipidemia as a key contributor to increased cardiovascular risk in this patient population.

Keywords: arterial hypertension, type 2 diabetes mellitus, obesity, lipid metabolism, cardiovascular risk, dyslipidemia, comorbidity

Arterial hypertension (AH), type 2 diabetes mellitus (T2DM) and obesity (OB) remain among the most common chronic non-communicable diseases in the world, which significantly contribute to the increase in cardiovascular morbidity and mortality [1]. Each of these pathologies has an independent negative impact on the state of the vascular bed, metabolic processes and functional activity of target organs, however, their combination causes mutual potentiation of pathogenetic mechanisms and the formation of adverse clinical and metabolic phenotypes.

Despite the successes in pharmacotherapy of hypertension and T2DM, the comorbid course of these diseases is often accompanied by insufficient control of blood pressure and lipid metabolism, which significantly increases the overall cardiovascular risk [2, 3]. Obesity, as a component of metabolic syndrome, contributes to the development of insulin resistance, impaired lipid homeostasis, and impaired sensitivity to antihypertensive and hypoglycemic therapy [4].

The relevance of this study is due to the need for a deeper understanding of the relationships between clinical indicators, the state of lipid profile compensation in conditions of combined pathology [5, 6].

Given the increasing prevalence of dyslipidemia among patients with AH, T2DM, and OB, disturbances in lipid metabolism represent a critical and often underestimated factor contributing to the overall cardiovascular risk [7, 8]. The clustering of these metabolic disorders not only complicates disease management but also accelerates atherogenic processes, making the identification and correction of lipid abnormalities an essential aspect of comprehensive patient care.

The aim of the study was to assess the features of the course of arterial hypertension in patients with concomitant type 2 diabetes mellitus and obesity, to study lipid metabolism indicators, and to establish correlations between them, which will allow to substantiate the directions of personalized therapeutic correction of such patients.

Materials and methods. The study involved 111 patients with hypertension. According to the study design, all patients with AH (n=111) with an average age of 55.26 ± 8.00 years were divided into 4 groups depending on the pathology: group 1 consisted of patients with AH – (n=22), with an average age of 54.36 ± 8.17 years, including 12 men and 10 women; group 2 − patients with AH+OB - (n=30), with an average age of 53.52 ± 9.24 years, including 16 men and 14 women (group 2); group 3 patients with AH in combination with T2DM – (n=31), with an average age of 56.26 ± 7.48 years – 15 men and 16 women; group 4 - patients with AH, T2DM and OB - (n = 28): 13 - men and 11 - women with an average age of 56.50 ± 6.83 years; as well as 20 people - the control group - 10 men and 10 women, the average age of the control group was 56.32 ± 8.00 years. Inclusion criteria: the presence of a verified diagnosis of stage 1 hypertension according to ESH (2018) [1] without signs of secondary hypertension, age 35–65 years, stable condition without exacerbations of concomitant pathology.

Exclusion criteria: heart failure III–IV functional class according to NYHA, severe renal failure (GFR <30 ml/min/1.73 m²), acute inflammatory or infectious diseases, oncological pathology , pregnancy.

Patients underwent a clinical examination with measurement of systolic and diastolic blood pressure (SBP and DBP), anthropometric studies (in particular, body mass index - BMI = body weight (kg) / height (m)²), biochemical blood tests with determination of: total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG) were determined by enzymatic method using reagent sets " Cholesterol liquicolor ", "HDL - Cholesterol " and " Triglycerides liquicolor » (Human , Germany) according to the manufacturer's instructions. The

content of very low density lipoproteins VLDL-C was calculated using the formula TG/2.22; the content of low density lipoproteins (LDL-C) was calculated using the formula WT Friedewald : VLDL-C=VLDL-(HDL-C+TG/2.22), mmol/l.

To determine the relationships between clinical and biochemical parameters, Pearson and Spearman correlation analysis were used , according to the nature of the data distribution. Statistical processing of the results was carried out using the Statistica 10.0 software. Values of $p<0.05$ were considered statistically significant.

Results and discussion. According to BP indicators, it was found that in patients in the AH group the average level of SBP was 143.29±11.53 mm Hg , in the AH+OB group — 144.74±10.08 mm Hg, in patients with AH+T2DM — 146.39±13.15 mm Hg , and in patients with the combined pathology of AH+OB+T2DM — 147.69±11.01 mm Hg . The DBP level in the AH group was 87.63±8.38 mm Hg , in patients with AH+OB — 89.76±9.32 mm Hg , with AH+T2DM — 90.14±7.67 mm Hg.s., and with the combination of AH + OB + T2DM — 89.16±10.27 mm Hg.s. Analysis of SBP and DBP indicators demonstrated the absence of statistically significant differences between the studied groups. This gives grounds to believe that the degree of AH control was not a factor that influenced the formation of changes in the cardiometabolic profile. It should be noted that all examined patients had AH grade 1, which reduced the risk of distortion of the study results due to different severity of AH. Such homogeneity of the sample allowed us to focus on the analysis of metabolic changes, without taking into account the influence of hypertension of different intensities, which increases the reliability and value of the conclusions obtained.

We analyzed the relationship between SBP and lipid metabolism indicators. Thus, according to the mathematical model of correlation between SBP and TC (Fig. 1), there is a significant relationship between SBP and TC.

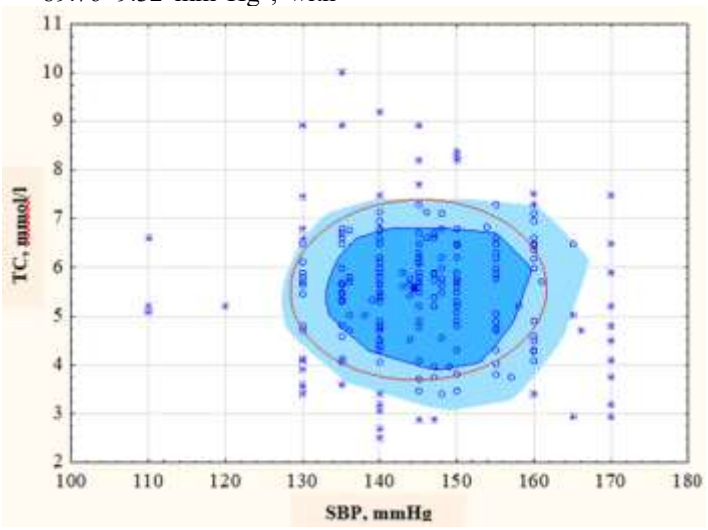

Fig. 1. Mathematical model of pearson correlation between the SBP level indicator and the level of TC (r = 0.47, p<0.05)

Similar trends were observed in the results of the analysis of correlations between the level of SBP and HDL (Fig. 2) and between SBP and TG (Fig. 3). The direction of the relationships between SBP and VLDL (Fig. 4) and SBP and LDL (Fig. 5), SBP and AI (Fig. 6) also did not change.

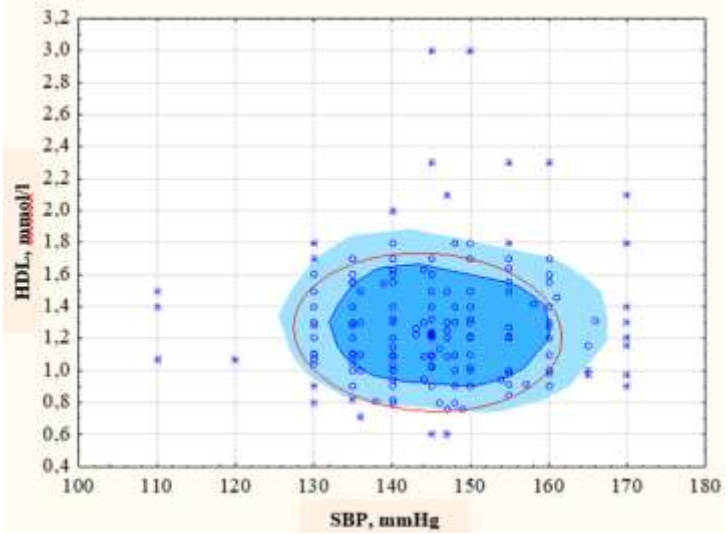

Fig. 2. Mathematical model of pearson correlation between the systolic blood pressure level and the HDL level (r = 0.25, p<0.05)

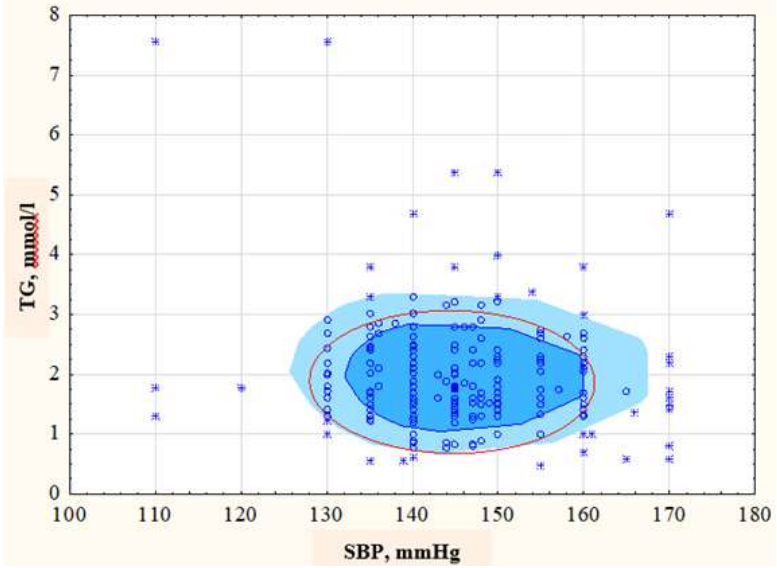

Fig. 3. Mathematical model of pearson correlation between the SBP level indicator and the TG level indicator (r = 0.25, p<0.05)

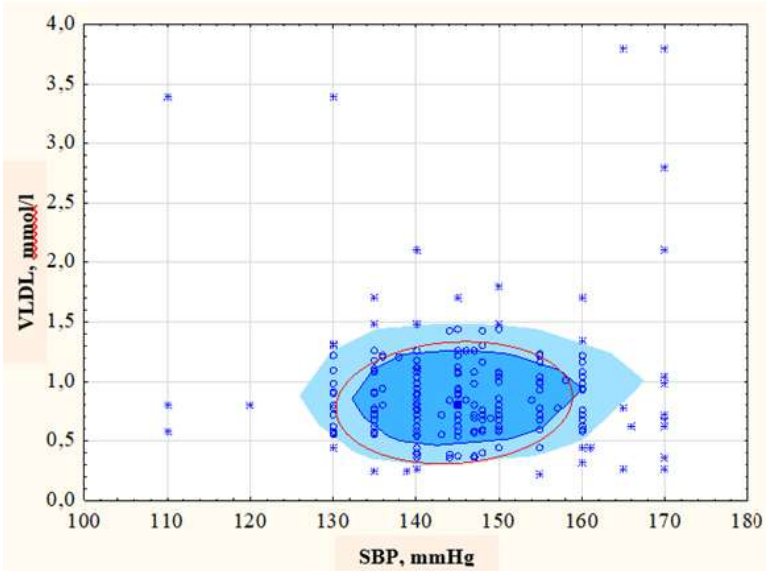

Fig. 4. Mathematical model of pearson correlation between the SBP level and the VLDL level (r = 0.25, p<0.05)

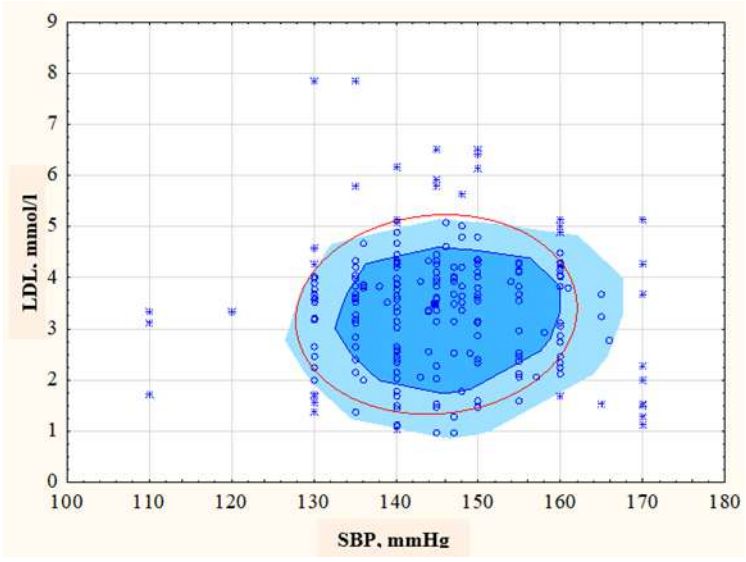

Fig. 5. Mathematical model of pearson correlation between the SBP level and the LDL level (r = 0.25, p<0.05)

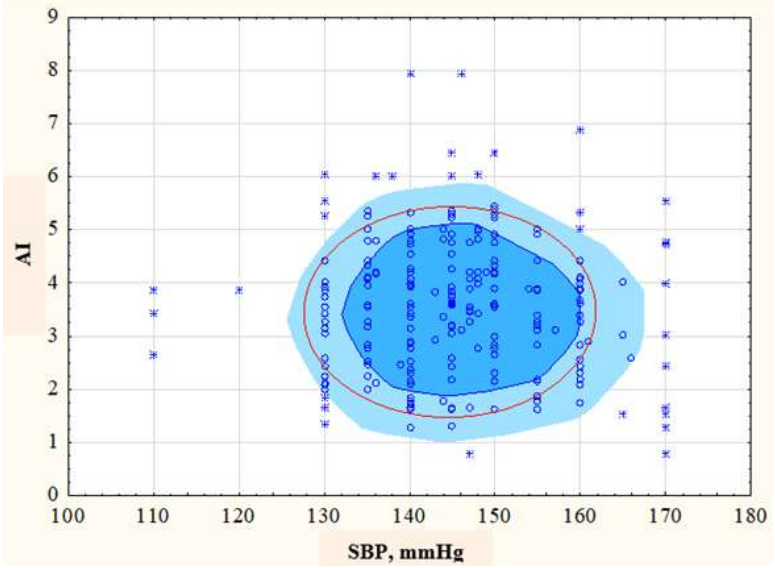

Fig. 6. Mathematical model of pearson correlation between the SBP level indicator and the AI level indicator (r = 0.25, p<0.05)

The results of the study demonstrate a direct relationship between blood pressure levels and lipid metabolism indicators.

The obtained data demonstrate an increase in CVD in patients with hypertension in the presence of dyslipidemia , which is clearly demonstrated in our study and is consistent with the work of other researchers.

In the groups of patients we examined, lipid metabolism indicators were studied (Table 1).

Table 1.

Indicators lipid profile of the subjects groups .

Indicators	AH n=22	AH+OB n= 30	AH+T2DM n= 31	AH+OB+T2DM n=28	p -value
	1	2	3	4	
TC, mmol / l	5.49±1.23	5.43±1.6	5.25±1.33	5.8±1.37	0.039 $^{3-4}$
HDL-C, mmol /L	1.20±0.38	1.28±0.35	1.26±0.4	1.3±0.31	>0.05
TG, mmol /l	1.86±0.91	1.87±0.7	1.78±0.95	2.09±1.04	>0.05
LDL-C, mmol /l	0.89±0.6	0.81±0.3	0.83±0.55	0.93±0.47	>0.05
VLDL-C, mmol /l	3.51±1.19	3.2±1.46	3.3±1.33	3.55±1.31	>0.05

As can be seen from the data presented in Table 1, the level of TC was significantly different in the group of patients with isolated AH compared to patients with comorbid pathology. Similar trends were found for other lipid metabolism indicators, namely HDL, TG, VLDL, LDL and AI. The obtained data indicate more negative changes in patients with AH with a combination of comorbid pathology of T2DM and OB.

The obtained results confirm the presence of a clinically significant impact of changes in lipid metabolism on the course of AH in patients with comorbid pathology. The identified reliable correlations between the level of systolic blood pressure and the main indicators of the lipid profile indicate a close relationship between lipid metabolism disorders and the degree of arterial pressure.

The absence of statistically significant differences in blood pressure levels between groups suggests that it is the features of lipid metabolism, rather than the degree of hypertension, that may play a more important role in the formation of subsequent vascular complications. The data obtained are consistent with literature sources, which emphasize the importance of hyperlipidemia in the progression of AH and the exacerbation of its complications.

Thus, the study confirms the need for simultaneous monitoring of lipid spectrum indicators in patients with hypertension to optimize the management of such patients.

Conclusions.

1. Patients with arterial hypertension and concomitant type 2 diabetes mellitus and/or obesity have more pronounced lipid metabolism disorders, in particular increased levels of total cholesterol and triglycerides .
2. Statistically significant positive correlations were established between systolic blood pressure and lipid metabolism indicators (total cholesterol, low-density lipoproteins, triglycerides), which indicates the importance of monitoring the lipid profile in the management of patients with arterial hypertension.
3. These studies emphasize the need to include correction of lipid metabolism in the standards of treatment of arterial hypertension in patients with comorbidities.

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